Five-Year Review Report

Fourth Five-Year Review Report
For
Kellogg-Deering Well Field Superfund Site
Town Of Norwalk
Fairfield County, Connecticut

September 2007

Prepared by

U.S. Environmental Protection Agency
Region 1
Boston, Massachusetts

Approved by:

James T. Owens, III, Director,
Office of Site Remediation and
Restoration, U.S. EPA, Region 1

Date:

9-28-07

EXECUTIVE SUMMARY

The remedy selected to address contamination at the Kellogg-Deering Superfund Site in Norwalk, Connecticut, includes air stripping for volatile organic compound in the well field [Operable Unit 1 (OU1)], ground-water and soil gas extraction and treatment at the source area (OU2), monitoring, and five-year reviews. This is the fourth five-year review for OU1 and the second five-year review for OU2. The triggering action for this statutory review is the completion of the last five-year review in 2002. Also discussed in this report are conditions in intermediate OU3 that is downgradient of the source area (OU2) and upgradient of the well field (OU1) where a remedy has not yet been selected

The assessment of this five-year review found that the OU1 remedy for the Kellogg-Deering Well Field is currently protective of human health and the environment and exposure pathways that could result in unacceptable risks are being controlled by the wellhead treatment system. However, should contamination from OU2 not be fully contained and if it is moving toward the well field, protectiveness in the future could be threatened if wellhead treatment is no longer occurring.

With the possible exception of vapor intrusion, the remedy for OU2 currently protects human health and the environment because exposure pathways that could result in unacceptable risks are being addressed through treatment and/or institutional controls that prevent direct contact with contaminated soil, inhalation of contaminated soil vapors, and use of contaminated site groundwater. Groundwater extraction and treatment continue, but VOC mass removal has not yet achieved the cleanup standards that were established in the ROD. Based upon a review of recent groundwater sampling, the possibility exists that the current groundwater extraction and treatment system may not be fully effective in hydraulically containing the Source Area groundwater. If this is the case the remedy may not be protective in the long term. In order for the remedy to be protective in the long-term, a reevaluation of the OU2 remedy should be considered to ensure that groundwater at OU2 is being treated to the maximum extent practicable.

Recent soil gas sampling indicates that vapor intrusion to residences and businesses is possible over an area that includes OU2 and OU3. The vapor intrusion pathway should be investigated and appropriate response measures taken to address unacceptable risks. Based upon the results of further investigation, vapor intrusion could present a current risk to some occupants of properties in the OU2 and OU3 areas of the Site.

The next five-year review is scheduled for completion in September 2012.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION

Site name: Kellogg-Deering Well Field Superfund Site		
EPA ID: CTD980670814		
Region: 1	State: CT	City/County: Norwalk/Fairfield

SITE STATUS

NPL status: **X** Final	Deleted	Other (specify)	
Remediation status (choose all that apply):	Under Construction	**X** **Operating**	Complete
Multiple OUs?* X YES NO	Construction completion date: 9/30/1997 (OU2)		
Has site been put into reuse? YES X NO			

REVIEW STATUS

Lead agency: **X** EPA	State	Tribe	Other Federal Agency _____
Author name: Leslie McVickar			
Author title: Remedial Project manager	**Author affiliation:** U.S. EPA		
Review period:** 09/ 30 / 2002 to 09 / 30 / 2007			
Date(s) of site inspection: May 29-30, 2007			

Type of review:

X	Post-SARA	____	Pre-SARA	____	NPL-Removal only
____	Non-NPL Remedial Action Site	____	Regional Discretion	____	NPL State/Tribe-lead

Review number: 1 (first) **X** 2 (second for OU2) 3 (third) **X**4(fourth for OU1)

Triggering action:

____	Actual RA Onsite Construction at OU #____	Actual RA Start at OU#	____
____	Construction Completion	Previous Five-Year Review Report	**X**
____	Other (specify) **Signing of ROD**		

Triggering action date *(from WasteLAN)*: 9/30/02

Due date (five years after triggering action date): September 30, 2007

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

FIVE-YEAR REVIEW SUMMARY FORM, CONT'D.

Issues:

Operable Unit 1 (OU1):

None.

Operable Unit 2 (OU2)

A large mass of contaminants remains in the source remediation area; high concentrations of VOCs persist in groundwater.

The current declining pumping rate may not fully contain the plume.

Elevated concentrations of contaminants in the Downgradient Area indicate that the treatment system is not fully containing the plume in OU2.

Vapor intrusion is a potential threat to businesses and residents in the area of the contaminant plume.

Operable Unit 3 (OU3)

The extent and fate and transport of contaminants in ground water are not fully known. Vapor intrusion to residences and businesses is possible over an area that includes OU3.

Recommendations and Follow-up Actions:

Operable Unit 1 (OU1)

None

Operable Unit 2 (OU2)

Evaluate methods that could increase the rate of contaminant removal and consider implementation of viable technologies.

Test the efficiency of each extraction well and recondition or replace wells if needed.

Review alternative pumping schemes to maximize contaminant removal and capture. Install additional wells in OU3 to demonstrate hydraulic containment by pumping.

Operable Unit 3 (OU3)

Complete the previously initiated assessment of the vapor intrusion pathway at OU3.

Protectiveness Statement(s)

The OU1 remedy for the Kellogg-Deering Well Field is currently protective of human health and the

environment and exposure pathways that could result in unacceptable risks are being controlled by the wellhead treatment system. However, should contamination from OU2 not be fully contained and if it is moving toward the well field, protectiveness in the future could be threatened if wellhead treatment is no longer occurring.

With the possible exception of vapor intrusion, the remedy for OU2 currently protects human health and the environment because exposure pathways that could result in unacceptable risks are being addressed through treatment and/or institutional controls that prevent direct contact with contaminated soil, inhalation of contaminated soil vapors, and use of contaminated site groundwater. Groundwater extraction and treatment continue, but VOC mass removal has not yet achieved the cleanup standards that were established in the ROD.

Recent soil gas sampling indicates that vapor intrusion to residences and businesses is possible over an area that includes OU2 and OU3. The vapor intrusion pathway should be investigated and appropriate response measures taken to address unacceptable risks. Based upon the results of further investigation, vapor intrusion could present a current risk to some occupants of properties in the OU2 and OU3 areas of the Site.

Long-Term Protectiveness

Based upon a review of recent groundwater sampling, the possibility exists that the current groundwater extraction and treatment system may not be fully effective in hydraulically containing the Source Area groundwater. If this is the case the remedy may not be protective in the long term. In order for the remedy to be protective in the long-term, a reevaluation of the OU2 remedy should be considered to ensure that groundwater at OU2 is being treated to the maximum extent practicable.

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LIST OF ABBREVIATIONS AND ACRONYMS

AO	Administrative Order
ARARs	Applicable or Relevant and Appropriate Requirements
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
CTDEP	Connecticut Department of Environmental Protection
CTDPH	Connecticut Department of Public Health
CWA	Clean Water Act
DCA	Dichloroethane
DCE	Dichloroethene
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	Feasibility Study
FDWD	First District Water Department
GAA	CT Groundwater classification: Existing or potential public supply of water suitable for drinking without treatment
GA	CT Groundwater classification: Existing private and potential public or private supplies of water suitable for drinking without treatment
GC	Gas chromatograph
gpm	gallons per minute
GZA	GZA GeoEnvironmental, Inc.
ITS	Integrated Treatment System
KDSSPG	Kellogg Deering Site Settling Parties Group
MCLs	Federal Maximum Contaminant Levels
mgd	Million Gallons per Day
MiBK	Methyl isobutyl ketone (also 4-methyl-2-pentanone)
MW	Monitoring Well
NCP	National Oil and Hazardous Substances Contingency Plan
ND	Non detect
NFTD	Norwalk First Taxing District
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NS	Not sampled
NUS	Nuclear Utility Services, Inc.

OU	Operable Unit
O&M	Operation and Maintenance
PCE	Tetrachloroethene
ppb	parts per billion
ppm	parts per million
PRPs	Potentially Responsible Parties
QA/QC	Quality Assurance/Quality Control
RAO	Remedial Action Objective
RAP	Remedial Action Plan
RCR	Remedial Construction Report
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Responsible Party
RSR	Remediation Standard Regulations
Site	Kellogg-Deering Well Field Superfund Site
SOW	Statement of Work
SRA	Source Remediation Area
SVE	Soil Vapor Extraction
SVEPAP	Soil Vapor Extraction Progress Assessment Plan
TBC	To be considered
TCA	Trichloroethane
TCE	Trichloroethene
THM	Trihalomethane
TtNUS	Tetra Tech NUS, Inc.
VOC	Volatile Organic Compound
UZ	Unzoned area
µg/Kg	Microgram per kilogram
µg/L	Microgram per liter

1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA) conducts this five-year review for the Kellogg-Deering Well Field Site (Site) in Norwalk, Connecticut, as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

CERCLA §121(c), as amended, states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The NCP part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The purpose of this five-year review is to determine whether the remedy for the Site is protective of human health and the environment. Specifically, the report addresses the following three questions stated in OSWER Directive #9355.7-03B-P, "Comprehensive Five-Year Review Guidance":

Question A: Is the remedy functioning as intended by the decision documents?

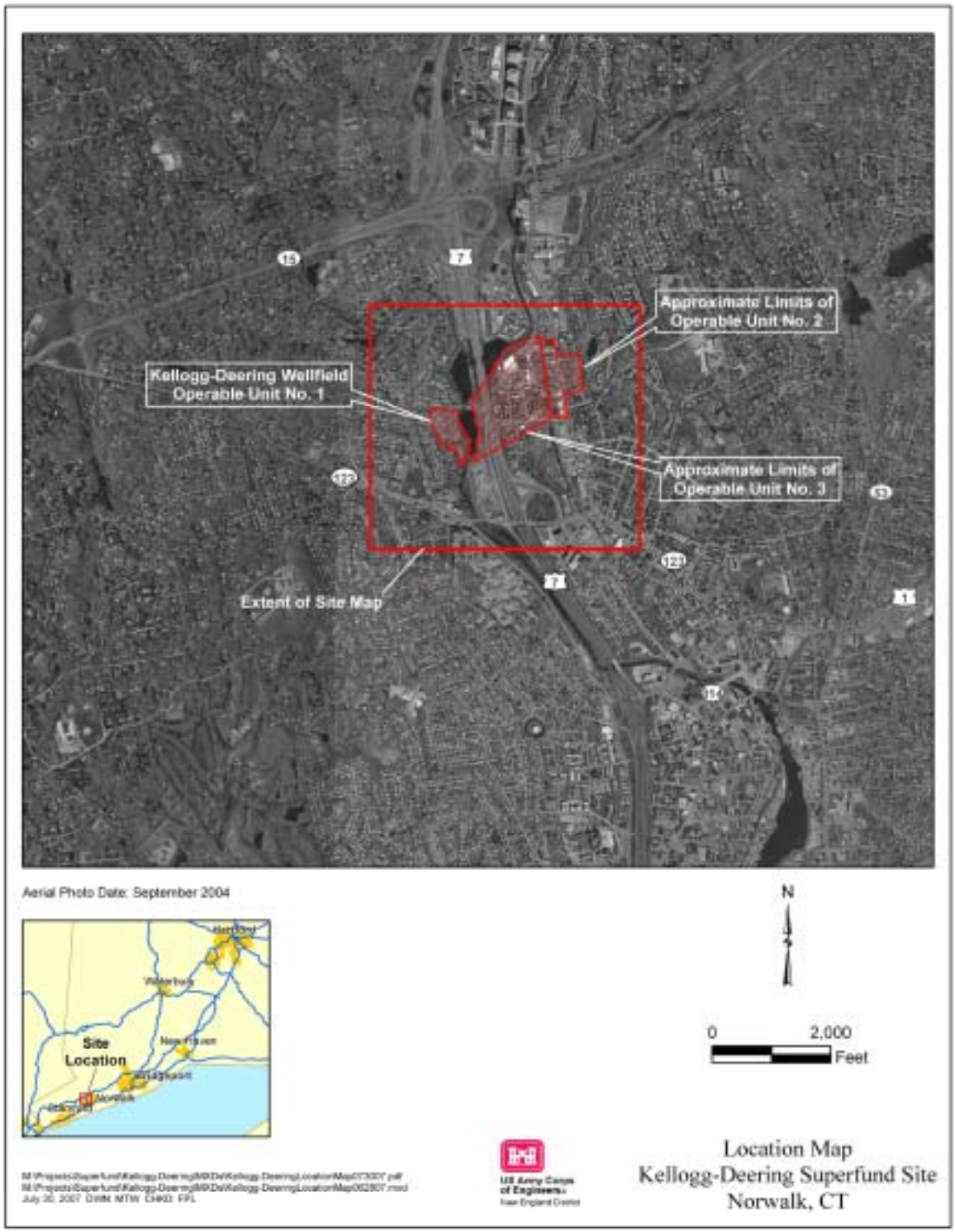
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The U.S. Army Corps of Engineers (USACE) was assigned by EPA to conduct this Five-Year Review at the Site and to prepare a report in accordance with an EPA-approved work plan dated March 2007. The findings and conclusions of this review are documented in this report. The report also identifies issues found during the five-year review process and offers recommendations to address such issues.

This is the fourth five-year review for the Site. The triggering action for this statutory review is the completion of the last five-year review in 2002. The five-year review is required because contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

Figure 1-1. Site location map for the Kellogg-Deering Superfund Site, Norwalk, Connecticut.



2.0 SITE CHRONOLOGY

The chronology of the site, including all significant site events and dates is included in Table 2-1.

Table 2-1. Chronology of site events.

Event	Date
Zell 1 building constructed by Zell Products Corporation (Zell).	1945
Zell 2 building constructed by Zell to expand production capability.	1955
First drinking water production well (Layne 1) installed at the Kellogg-Deering well field.	1955
Elinco building constructed by Zell to perform similar operations as Zell 1 and Zell 2.	1961
Second drinking water production well (Deering 1) installed at the well field.	1965
Third drinking water production well (Deering 2) installed at the well field.	1966
Pitney Bowes takes over Zell 2 building and installs engineering offices.	1974
Fourth drinking water production well (Layne 2) installed at the well field.	1975
Trichloroethylene (TCE) first detected by the Norwalk First Taxing District (NFTD) during routine sampling of Kellogg-Deering Well Field.	1975
NFTD installs redwood slat aerator on Layne 2.	5/1981
Kellogg-Deering Well Field Site proposed for inclusion on the National Priorities List (NPL).	9/8/1983
Kellogg-Deering Well Field Site placed on the NPL.	9/21/1984
NFTD installs air stripper on Layne 2 for more efficient removal of organic constituents. Air stripper not put into operation due to equipment problems.	1985
Remedial Investigation (RI) completed for OU1. EPA separates the Site into two operable units: OU1 is the well field, OU2 is the "Source Area".	4/1986
Feasibility Study (FS) completed for OU1.	6/1986
EPA issues Record of Decision (ROD) for OU1.	9/1986
CTDEP issues Consent Order for the Complex (4 groundwater extraction wells and air stripper installed).	10/1987
Supplemental RI/FS initiated to provide further information regarding the source(s) and extent of groundwater contamination at OU2.	1987
Administrative Order for OU1 remedy issued to NFTD by EPA.	5/1/87
Air stripper begins operating on Layne 2 (OU1 remedy).	1988

TABLE 2-1 (cont.)

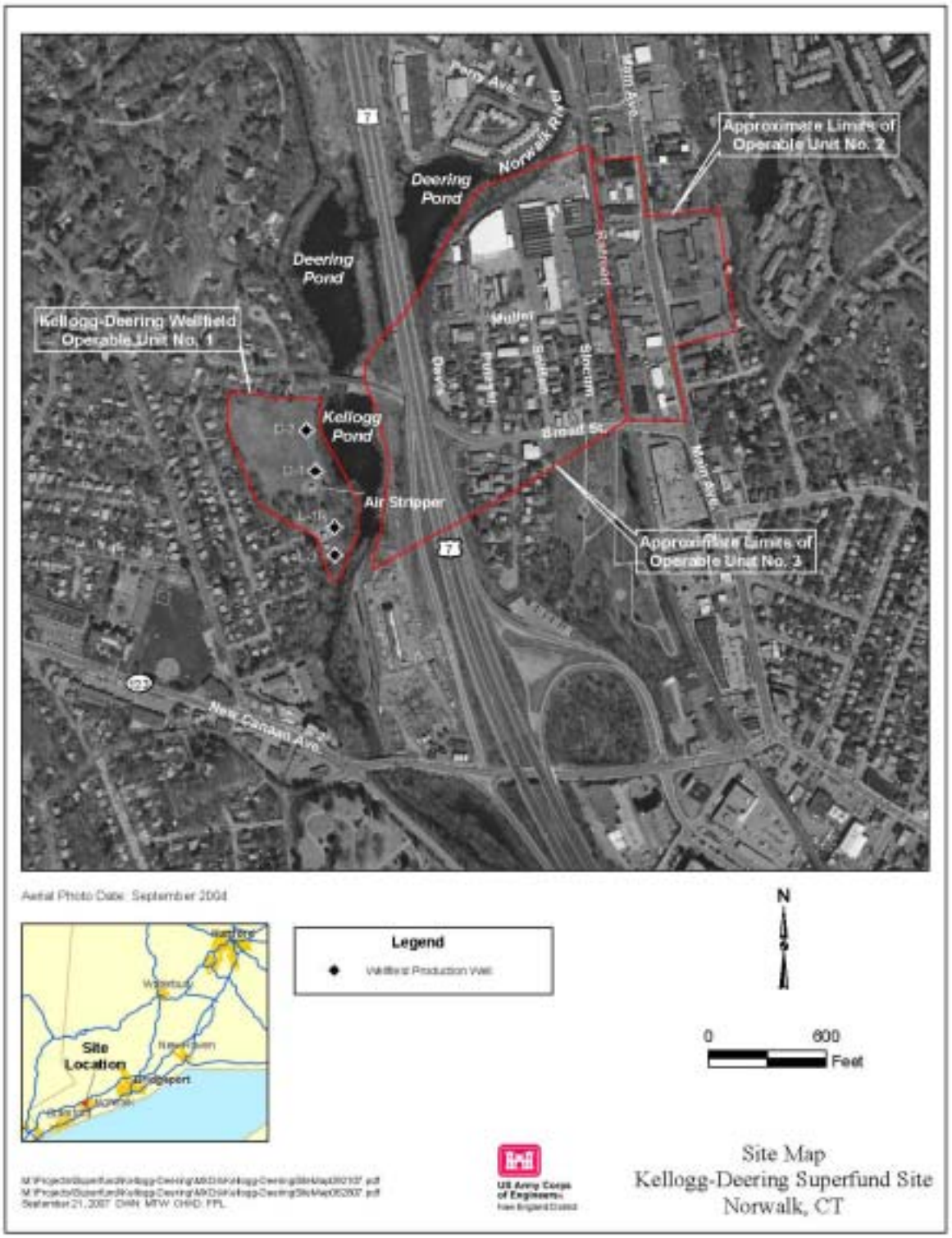
Event	Date
Connecticut DEP letter to NFTD grants an exemption to air emissions permitting requirements.	7/1988
Supplemental RI/FS completed for OU2.	7/1989
EPA issues ROD for OU2 providing for source control and management of migration at the source area.	9/1989
Statement of Work issued by EPA for the OU2 remedial action.	9/1990
Consent Decree for OU2 signed between EPA and Potentially Responsible Parties (PRPs).	11/1992
First five-year review completed (OU1).	12/1992
Pre-Design Report for soil at OU2 submitted to EPA.	6/1994
Remedial Design for OU2 approved by EPA.	12/1994
Final Remedial Design Report/Plans and Specifications for OU2.	1/1995
Construction of soil-vapor extraction (SVE) and groundwater extraction systems begins at OU2.	9/1995
OU2 SVE system startup.	4/1996
OU2 Groundwater extraction and treatment system startup.	5/1996
EPA inspection of OU2 SVE and groundwater extraction and treatment systems.	9/4/1996
Operations and Management (O&M) of the SVE system and groundwater extraction and treatment systems begins at OU2.	9/30/1996
Final Remedial Construction Report (RCR) for OU2 remedy submitted to EPA.	11/1996
EPA issues Declaration for the Explanation of Significant Differences (ESD).	3/1997
Second five-year review completed (OU1).	9/1997
EPA agrees to modify the operation of the OU2 SVE system from full-time to cyclical operation on a monthly schedule while the remedial progress issues are being discussed.	8/1999
PRPs prepare a pre-screening soil sampling and analysis program workplan to evaluate the impact of using Method 5035 to confirm the attainment of clean-up goals at OU2.	9/29/1999
PRPs implement above-mentioned sampling and analysis program, collecting and analyzing soil samples using Method 5030, Method 5035, and Method 1312 to compare results.	11/1999
Kellogg-Deering Site Settling Parties Group (KDSSPG) submits Soil Vapor Extraction Progress Assessment Plan (SVEPAP).	4/10/2000
PRPs propose a revision to the monthly cycling operation of OU2 SVE system. SVE system shut down in early August 2000.	8/4/2000

EPA agrees to change the SVE pulsing intervals from monthly cycles, to six months off and one-plus days on.	9/1/2000
OU2 SVE system restarted for approximately three weeks.	2/2001
PRPs submit an Integrated Treatment System Progress Report addressing remedial progress of both the SVE and groundwater treatment systems (OU2).	3/14/2001
Five-Year review completed for OU1, OU2, and OU3.	9/2002
Site reuse assessment prepared by EPA	9/2004
Remaining contaminated soils removed for off-site disposal.	2006
Soil cleanup goals achieved. Soil Vapor Extraction System discontinued and dismantled.	2006
Soil Cleanup Completion Report submitted by GZA GeoEnvironmental, Inc.	3/2006
Phase I vapor intrusion pathway assessment report submitted by Tetra Tech NUS, Inc.	8/2006
Five-Year review completed for OU1, OU2, and OU3 (this report).	9/2007

3.0 BACKGROUND

The Kellogg-Deering Well Field Superfund Site (Site) is in Norwalk, Fairfield County, Connecticut and consists of an approximately 10-acre municipal well field and the adjacent area that contributes to the well field contamination (Figure 3-1). EPA has divided the Site into three operable units (OU) for the purpose of selecting and implementing remedial actions. OU1 encompasses the 10-acre well field, which was the initial area of contaminant detection. OU 2 encompasses the upgradient contaminant source area, also known as the Source Remediation Area (SRA). OU 3, also known as the Downgradient Area, includes the area of contamination downgradient from the source area but upgradient from the well field (EPA, 1989). An RI/FS process has not been initiated for OU3. A map depicting the relative locations of operable units is presented in Figure 3-1.

Figure 3-1. Locations of operable units and site features, Kellogg-Deering Superfund Site, Norwalk, Connecticut.



3.1 Physical Characteristics

The following is a summary of the physical characteristics of the Site and vicinity.

3.1.1 OU1—Kellogg-Deering Well Field

The Kellogg-Deering Well Field occupies approximately 10 acres along the western bank of the Norwalk River. The well field is bordered on the north, south, and west by residential properties; and bordered on the east by Kellogg Pond on the Norwalk River. Route 7, an inactive landfill across the river from the well field, and several commercial/light industrial buildings are located to the east of the well field across the Norwalk River. None of the businesses have been identified as potential sources of contamination to the well field, nor have any been ruled out as potential sources of contamination to OU3 (NUS, 1989).

The topography of the well field is generally flat, and the ground surface is covered with grass. According to flood insurance maps for the City of Norwalk, OU1 lies within the 100-year floodplain of the Norwalk River. Overburden materials in OU1 consist mostly of glacially-derived sand and gravel and are between 40 and 110 feet thick. A contour map of the bedrock surface at OU1 indicates that parts of the Well Field lie within a bedrock valley approximately parallel to the Norwalk River. The maximum measured overburden thicknesses were observed within this buried valley (NUS, 1989).

3.1.2 OU2—Source Remediation Area

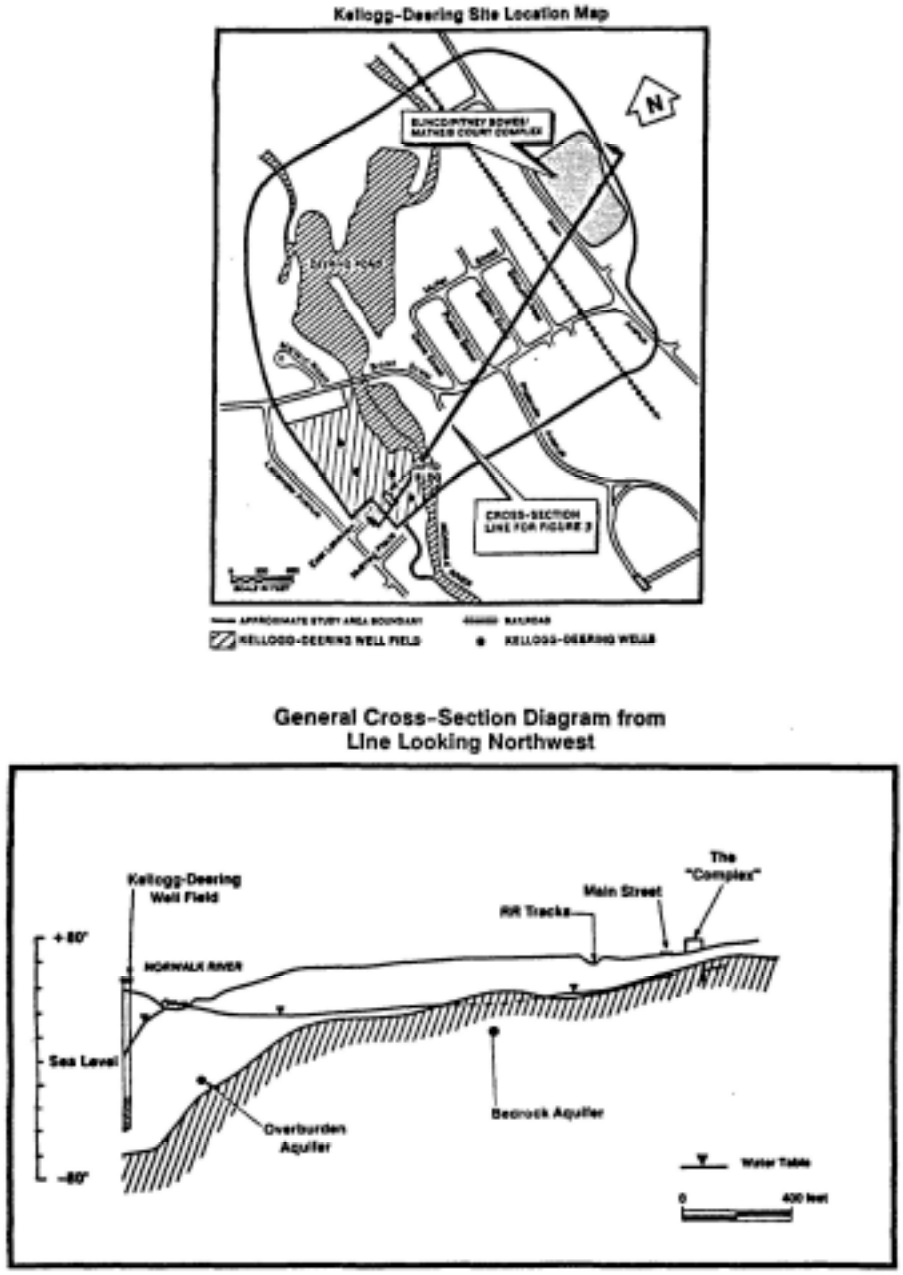
The Source Remediation Area (SRA), also named OU2, is an approximately 9.5-acre area located northeast of OU1 on the opposite side of the Norwalk River. The SRA was defined in the 1989 ROD as the area where trichloroethene (TCE) concentrations in groundwater exceed 6,600 parts per billion (ppb). The Elinco/Pitney Bowes/Matheis Court Complex (the Complex) is a group of buildings within the SRA from which contamination originated. The Complex covers approximately 6 acres located roughly 2,000 feet east of OU1 at 272 and 282 Main Avenue (Figures 3-1 and 3-2). Most of the Complex and surrounding areas are covered with asphalt pavement. The three buildings of the Complex were demolished in the summer of 2007.

Figure 3-2. Site features, well locations, and graphs of TCE concentrations with time in and near Operable Unit 2 (OU2) Kellogg-Deering Superfund Site, Norwalk, Connecticut (modified from Figure 4-3, Tetra Tech NUS, Inc., 2002).

The SRA includes the Complex and the area extending approximately 600 feet west, 500 feet north, and 600 feet south of the Complex (Figure 3-2). Several businesses within this area on the west side of Main Avenue include a car wash, auto painting, and a service station. As shown in the ROD, the SRA is bordered to the north by a housing development for the elderly and several businesses; to the west by railroad tracks and Slocum Street; to the south by commercial properties along Broad Street, and to the east by condominiums. The ground surface at the SRA generally slopes from east to west (elevation 70-100 feet) toward the Norwalk River (elevation approximately 40 feet). The ground surface east of the SRA rises steeply above a concrete retaining wall at the east side of the Complex. A north-south trending ridge about 2,000 feet east of the complex is at an elevation of about 230 feet. Flood insurance maps indicate that the SRA is not within the 100-year floodplain of the Norwalk River.

Bedrock crops out where the surface topography rises steeply east of OU2. From the eastern boundary of OU2 to Main Avenue, overburden material consists of approximately ten feet of dense sand and gravel and/or glacial till over bedrock. The thickness of unconsolidated materials ranges from 15 to 30 feet between Main Avenue and the railroad tracks (NUS, 1989). A bedrock ridge underlies the SRA. The general configuration of the bedrock surface along the ridge is shown in the generalized geologic section of Figure 3-3. The water table shown on the cross section is either within or slightly above the bedrock surface east of a buried valley under the Norwalk River. Recent water-level maps show a similar water-table position (GZA, 2007).

Figure 3-3. Generalized geologic section, Kellogg-Deering Superfund Site, Norwalk, Connecticut (from Record of Decision for OU1, 1986).



During pre-design field investigations for the OU2 remedy, a 1- to 2-foot wide fracture zone at a depth of 44 to 54 feet below ground surface was identified between the Zell 1 building and the Metro-North Railroad tracks. According to GZA (1995) this fracture zone transmits most of the groundwater flow westward from the Complex.

3.1.3 OU3—Downgradient Area

The Downgradient Area (also known as OU3) was defined in 1989 in the ROD for OU2 as the area downgradient of the SRA (but upgradient of the well field) where TCE concentrations in groundwater range between 5 ppb and 6,600 ppb. OU3 is bordered (approximately) to the north and west by Deering Pond and the Norwalk River, to the east by OU2 and the Metro-North railroad tracks, and to the south by St. Mary's Cemetery and Plattsville Avenue. The extent of TCE in groundwater, however, is not well defined. Land usage in OU3 is primarily residential properties and several commercial and light industrial facilities located along Muller Street and on the south side of Broad Street. The land surface in OU3 generally slopes from east to west towards the Norwalk River. The western parts of OU3 are located within the 100-year floodplain of the Norwalk River.

Overburden material within OU3 consists primarily of glacial sand and gravel deposits. Overburden is 15 to 30 feet thick between the railroad tracks and Pulaski Street. Thickness increases gradually to approximately 65 feet near the east side of the Norwalk River. The bedrock surface in OU3 slopes uniformly from east to west between the railroad tracks and Davis Street and steepens between Davis Street and the Norwalk River (NUS, 1989).

The Supplemental RI/FS identified a large fracture zone near monitoring well K-21 (Figure 3-2) at a depth of 138 to 145 feet below ground surface (bgs) (98 to 105 feet below the top of bedrock). Yields of the fractured interval at well K-21were estimated to exceed 50 gallons per minute. Bedrock fractures were determined to be the main conduits for contaminant migration between the Complex, through OU3, and to the Well Field (NUS, 1989).

3.2 Land Resource and Use

The following is a summary of ownership, operational, and land use history for the Site and vicinity.

3.2.1 OU1—Kellogg-Deering Well Field

The Kellogg-Deering Well Field, also known as the Smith Well Field, is owned and operated by the Norwalk First Taxing District (NFTD) Water Department. The well field consists of four municipal supply wells (Layne 1 Replacement [L-1R], Layne 2 [L-2], Deering 1 [D-1], and Deering 2 [D-2]), which supply drinking water to approximately 45,000 people. Well locations are shown in Figure 3-1. NFTD has owned parts of the well field since approximately 1935. The first production well (Layne 1) was installed in 1955, and subsequent wells were installed within the next 20 years. Layne 1 was permanently capped and removed from service in 1994 due to elevated levels of TCE, iron, manganese, and suspended solids, and L-1R was installed to replace it (B&RE, 1997). All four production wells are tied to the wellhead treatment system.

The Well Field is in an aquifer classified as II-A under EPA's Groundwater Protection Strategy and GAA under Connecticut's Water Quality Standards. These classifications both indicate that the aquifer is an existing or potential public drinking-water supply. The NFTD is the only user of groundwater from the

aquifer. The aquifer beyond the well field is classified by Connecticut as GA, which is defined as groundwater within the area of existing private water supply wells or in an area with the potential to provide water to public or private water-supply wells. For such areas, the state's policy is to restore groundwater to the extent feasible to a quality suitable for drinking without treatment.

At present, the primary source of public water to the NFTD is surface water from four reservoirs located in Norwalk and adjacent communities. Reservoir water is blended with well field water at varying ratios depending on reservoir reserves and distribution system location. Normal daily water production for the well field is approximately one million gallons per day (mgd), but the well field is capable of yielding five mgd. A typical blend of drinking water supplied by NFTD contains 10 to 20 percent well field water. (George Fulton, NFTD Engineer, verbal communication, May 2007). According to maps reviewed at the City of Norwalk Planning and Zoning Offices, the well field is a "UZ", or unzoned area.

3.2.2 OU2—Source Remediation Area (SRA)

The Complex consisted of four buildings within the SRA that formerly supported light industrial activity which included the production of metal cosmetic and handbag frames. Manufacturing processes at the Complex included plating and solvent cleaning, apparently with TCE, although other solvents may have been used. The Complex was identified in the Supplemental RI as the major source of VOC contamination to groundwater in OU1, but the existence of other source areas contributing to the contamination was not precluded.

The Zell 1 Building (276 Main Avenue) was built in the mid-1940s by the Zell Products Corporation. In 1969, Pitney Bowes Corporation occupied Zell 1 and used it as a warehouse. The building was later renovated in 1977 and used for office and warehouse space.

The Zell 2 building was constructed in 1955. In 1974, Pitney Bowes occupied the facility and converted it into office space.

The Elinco Building (272 Main Avenue) was constructed in by Zell 1961. Elinco Corporation took over the building in the mid-1970s to produce fractional horsepower motors. The Elinco building was used for manufacturing until the late 1990s.

The Zell 1, Zell 2, Elinco Buildings were demolished in the summer of 2007, but the cement slab floors of the building and the building foundations remain

The Matheis Court Building (7 Matheis Court) is an office building constructed at the south end of the Complex in 1984. The upper floor above the parking area is currently occupied as office space.

Businesses and other buildings located within the SRA that are not part of the Complex include a shopping plaza, car wash, restaurant, gas station, assisted living facility, and several single-family residences. According to maps reviewed at the City of Norwalk Planning and Zoning Offices, the SRA is zoned as a "B2" area. B2 zoning allows for mixed use and multi-family residential uses with certain height restrictions (Norwalk, 2002). Groundwater in OU2 is not used as a source of drinking water; all businesses and residences are served by the city water supply.

3.2.3 OU3—Downgradient Area

OU3 is primarily occupied by single- or multi-family homes along Slocum, Sniffen, Pulaski, and Davis Streets. Light industrial facilities are currently operating to the north of Muller Street in the Muller Industrial Park, the east of Slocum Street, and south of Broad Street. All are served by municipal water. As discussed in the 1997 ESD, Connecticut law strictly regulates the drilling of water supply wells (see Conn. Gen. Stat..§. 25-126 et seq.). This law and the pertinent provisions of the Connecticut Public Health Code (Conn. Agencies Regs. §19-13-B51m) do not provide for any exemptions that would permit the drilling of water-supply wells on properties on the Site, thus preventing the use of groundwater in this area

3.3 History of Contamination

Elevated levels of TCE in groundwater were first detected at the well field in 1975 during routine sampling (EPA, 1986). Wells with unacceptable levels of TCE were shut down. Between 1975 and 1980 the Connecticut Department of Environmental Protection (CTDEP) performed several inspections, collected samples from the well field and adjacent areas, and initiated investigations of several local industries in an effort to determine the extent of groundwater contamination.

3.4 Initial Response

In 1981 NFTD installed a redwood slat aerator on production well Layne 2 (L-2) (which had unacceptable levels of TCE) to allow continued use of the well for City drinking water. In February 1985, the NFTD awarded a contract for installation of a more efficient air stripper and storage tank. This air stripper was installed on Layne 2 in 1985, but was not put into use due to cracks in a holding tank that was integral to the operation of the unit. As of May 2007, the air stripper had operated since 1988 and received water from all wells in the well field.

In 1986, an RI initiated at the Site that concluded that the source of contamination to the well field was located to the east of the well field. The RI recommended additional investigations to delineate the lateral extent of the contaminant plume. This was undertaken in a Supplemental RI conducted in 1987.

3.5 Summary of Basis for Taking Action

The detection of TCE in public water-supply wells prompted environmental investigations at OU1. Several other contaminants were detected in groundwater samples collected from the well field during the RI/FS; the maximum concentrations of the contaminants of concern (COCs) detected during the RI are presented in Table 3-1. TCE and 1,2-dichloroethene (DCE) were detected in more than half of the locations sampled. A risk assessment performed as part of the RI/FS for OU1 determined the incremental lifetime carcinogenic risk associated with the use of groundwater from the well field to be 1.8×10^{-4} for adults, which is above the generally accepted permissible risk limit of 10^{-6} that was used in 1986. EPA projected that if no action was taken to control or mitigate the contaminant plume, contaminant concentrations would increase by a factor of ten over the next 30 years due to migration of the contaminant plume from OU2. This projected increase would have resulted in a corresponding increase in the risks associated with use of groundwater from the well field by one order-of-magnitude.

Table 3-1. Maximum concentrations of contaminants of concern (COCs) detected in groundwater from the well field, Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut (EPA, 1986).

Contaminant	Concentration µg/l	Contaminant	Concentration µg/l
TCE	100,000	Vinyl Chloride	136
Tetrachloroethene (PCE)	1,500	Benzene	260
1,2-DCE	4,000	Toluene	240
1,1-Dichloroethane (DCA)	38	Xylenes (total)	590
1,1,1-Trichloroethane (TCA)	4	Ethylbenzene	72
1,1,2-TCA	630	Phenol	72
Methylene Chloride	900	1,2-Dichlorobenzene	4
Chloroform	600		

In 1987, a Supplemental RI/FS investigated potential sources of contamination to OU1. A risk assessment performed for the Supplemental RI identified the following COCs (Table 3-2) in soil and groundwater in OU2:

Table 3-2. Contaminants of Concern (COCs) in soil and groundwater at OU2, Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut (EPA, 1989).

PCE	Benzene
TCE	1,1,1-TCA
1,1-DCE	1,2-DCE
Vinyl chloride	Toluene
Chloroform	Ethylbenzene
Methylene chloride	Xylenes
1,1-DCA	Acetone
1,2-DCA	4-Methyl-2-pentanone

EPA determined that exposures to groundwater from OU1 containing these contaminants would pose a significant threat to public health if not for the dilution provided by infiltration from the Norwalk River and the removal of contaminants by the existing air stripper. EPA determined that contamination in the aquifer at OU2 would pose a threat to human health if the aquifer were used as a source of drinking water.

The EPA risk assessment also determined that the volatilization of contaminants in soils beneath the Complex posed a risk to users of the buildings, and that future building demolition or soil excavation in the Source Area would substantially increase the risk to public health through direct contact with existing soil contamination. Additionally, EPA concluded that contamination in the soils in the Source Area would be a continuing source of contamination to groundwater unless concentrations were reduced.

No significant levels of contaminants were found in surface water or sediments during the initial RI, and no further sampling or risk assessment was performed during the Supplemental RI.

4.0 REMEDIAL ACTIONS

This section provides a summary of remedial actions that have been implemented at the Site.

4.1 OU1—Kellogg-Deering Well Field

The Site was placed on the NPL in 1984. In 1986, after completion of the RI/FS, EPA issued a ROD documenting the development and screening of remedial alternatives for the well field (OU1). The primary Remedial Action Objective (RAO) of the 1986 ROD is to assure a reliable supply of safe, potable water to the public dependent on the well field.

4.1.1 OU1—Remedy Selection

The ROD for OU1 was signed on September 25, 1986. EPA recommended repair of the holding tank that had been preventing operation of the existing air stripper on Layne 2; and implementation of an operation, monitoring, and maintenance plan for the air stripper. Air monitoring was specifically recommended to confirm that air emissions treatment would not be required (EPA, 1986). On July 28, 1988, CTDEP wrote to NFTD confirming that air emissions from the air stripper would not exceed state regulatory limits and no air emissions permit would be required (CTDEP, 1988). It was proposed that treated water would be discharged to the existing conventional water treatment plant and distribution system (EPA, 1986).

4.1.2 OU1—Remedy Implementation

In May 1987, EPA issued an Administrative Order, Docket No.: 1871067 (AO), to the NFTD to complete construction of, and to begin operating, the air stripper as required by the ROD. This wellhead treatment facility became operational in 1988, and has been operating since. In February 1993, EPA completed the first five-year review and concluded that the treatment system was removing 100 percent of the contaminants tested for and that safe drinking water standards were being met.

4.1.3 OU1—Operation and Maintenance

The AO issued by EPA to NFTD in May 1987 detailed specific requirements for the ongoing operation of the air stripper in order to ensure that the primary RAO is achieved. The primary goal of operation and maintenance of the treatment system is to ensure that no water from the well field exceeding Federal and/or State contaminant levels enters into the public water supply distribution system. The monitoring program proposed by EPA to ensure that this goal was achieved included the following:

- Groundwater monitoring on the east side of the Norwalk River for early detection of migration of high levels of contamination toward the well field,
- Water monitoring at the well field prior to stripping, after stripping, and prior to discharge into the public water supply system,
- Water monitoring at various points along the distribution system,

In addition, the AO specified that a maintenance plan, to be approved by EPA, should also be developed to establish a schedule for all necessary maintenance activities to ensure the proper continuous operation of the treatment system including annual inspections of the air stripper unit and anticipated additional repairs to the storage tank after fifteen years of operation. Also, the AO specified the preparation of a

contingency plan to establish detailed measures to be taken in the event that the air stripper failed to reduce contaminant concentrations below Federal and/or State maximum acceptable levels for drinking water, due to mechanical failure or any other reason.

EPA notified the NFTD in May 1988 of the successful implementation of the remedial action.

O&M activities associated with OU1 have been integrated into the standard operations of the NFTD. Routine maintenance for the air stripper system is performed by NFTD staff. The motor is taken out annually and replaced with a rebuilt motor from the previous year, so there is always a spare ready. Documentation of water quality after stripping prior to discharge to the distribution system is routinely provided, along with other required water-quality information, to the Connecticut Department of Public Health (CTDPH) (Tracey Pierson, NFTD, written communication, July 2, 2007).

4.2 OU2—Source Remediation Area

In 1986, EPA initiated a Supplemental RI/FS to further investigate the extent of contamination in the upgradient contaminant plume that was presumed to be providing a continuing source of contamination to the well field. The Supplemental RI/FS determined that the Complex was a major source of groundwater and soil contamination that was contributing to the contamination of the well field. The existence of other source areas contributing to the contamination, however, was not precluded

EPA issued a ROD in 1989, which separated the management of migration component for the area upgradient of the well field into two operable units. Operable Unit 2 was termed the "Source Area," and was characterized by TCE concentrations greater than 6,600 µg/l. OU3 was defined as the "Downgradient Area," characterized by TCE concentrations exceeding 5 µg/l but less than 6,600 µg/l. The 1989 ROD addressed the Source Area (OU2) only. Remedial decisions for OU3 were deferred.

The following RAOs were established in the ROD:

- Prevent further introduction of contaminated groundwater from the Source Area to the Downgradient Area and ultimately to the production wells at the Kellogg-Deering Well Field and the Norwalk River,
- Restore the Source Area aquifer to drinking water quality,
- Reduce the mass of contaminants at the Source Area, and
- Prevent human consumption of or contact with contaminated soil and groundwater above the cleanup goals presented in the ROD (EPA, 1989).

4.2.1 OU2—Remedy Selection

The ROD for OU2 was signed on September 29, 1989. EPA's selected remedy included source control and management of migration components. The source control component included the design, installation, operation, and maintenance of an in-situ vacuum extraction system to remove VOCs from vadose zone soils. The management of migration component included the design, installation, operation, and management of a groundwater extraction, treatment, and disposal system to remove VOCs from groundwater in the Source Area. The selected groundwater treatment method was air stripping. The soil and groundwater treatment systems were integrated to provide treatment of air from each component through the use of carbon adsorption. Institutional controls associated with the selected remedy included

restrictions on the installation and use of private wells in the Source (OU2) and Downgradient (OU3) Areas and restrictions on soil excavation in areas of contamination (EPA, 1989).

The ROD specified the soil cleanup standards at the Complex shown in Table 4-1 as ranges due to differences in soil types in areas of contamination. The ROD indicated that further refinement of the soil cleanup levels would be completed during the remedial design process.

Table 4-1. Soil cleanup standards established in the ROD for OU2, Kellogg-Deering Well Field Superfund Site, Norwalk Connecticut.

Contaminant	Cleanup Standard (ug/kg)
Benzene	1.2 – 36.7
Toluene	5,523 – 169,552
Ethylbenzene	13,771 – 422,750
1,1,1-TCA	560 – 17,332
1,2-DCA	0.6 – 7.9
PCE	33 – 1,036
TCE	12 – 358
1,2-DCE (total)	76 – 2,321
1,1-DCE	8.3 – 256
Vinyl chloride	0.3 – 9
4-Methyl-2-pentanone (MiBK)	1,246 – 38,243

The management of migration remedy (groundwater extraction, treatment, and discharge) was to consist of a pumping well network designed appropriately to intercept groundwater contaminated with VOCs throughout OU2. The cleanup standards shown in Table 4-3, which were established in the ROD, for contaminated groundwater at the Complex. These standards are federal Maximum Contaminant Levels (MCLs):

Table 4-2. Groundwater cleanup standards established in the ROD for OU2, Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut.

Contaminant	Cleanup Standard (µg/L)
Benzene	5
Toluene	2,000
Ethylbenzene	680
1,1,1-TCA	200
1,2-DCA	5
PCE	5
TCE	5
1,2-DCE (total)	70

1,1-DCE	7
Vinyl chloride	2
4-Methyl-2-pentanone	350

4.2.2 OU2—Remedy Implementation

In November 1992, EPA and four Potentially Responsible Parties (PRPs) signed a Consent Decree for implementation of the RD/RA for OU2. Appendix II to the Consent Decree presented the Statement of Work (SOW) for the design, installation, operation, and management of the integrated treatment system (ITS). EPA approved an interim RD Report on December 29, 1994; and the Final Remedial Design Report was submitted by the PRPs on January 9, 1995 (GZA, 1995).

The SOW outlined specific requirements for the implementation of the selected remedies. The source control remedy (in-situ vacuum extraction) was to consist of a network of soil-vapor extraction (SVE) wells and/or trenches and injection wells, if warranted, designed appropriately to intercept VOC contamination in unsaturated soil throughout OU2. The SOW outlined the requirements for a sampling and analysis program to be implemented during each phase of the project to monitor the performance of the SVE system, monitor treatment and process gas discharges, and monitor the indoor air of the buildings at the Complex.

The SVE system was designed to treat soils in six general areas of the Complex where VOC concentrations exceeded cleanup goals as follows:

- Three areas associated with the former Zell Products process areas inside of the Elinco Building, Zell 1, and Zell 2;
- The Zell/Elinco Corridor;
- An area in the courtyard between Zell 1 and Zell 2; and
- A small area just north of the Matheis Court Office Building. (GZA, 1995c)

A potential seventh area was identified below the Matheis Court Building based on elevated soil gas VOC concentrations. During SVE construction additional samples were collected, and the area below the building was determined to require remediation. This area and the area north of the building were covered in a single network for both the indoor and outdoor areas of the Matheis Court Building. The six soil remediation areas are shown on Figure 4-1. Installation of the 28 SVE wells, 11 air inlet wells, and nine soil vapor probes for the SVE system commenced on September 19, 1995. Installation of the piping network began in December 1995 and by March 1996 the piping network was prepared for leak testing. The SVE system covering the six remediation areas was activated on April 25 and 26, 1996. In July 1996, the RP's contractor modified several of the SVE wells in response to observed difficulties from the infiltration of water to the manifold piping of the extraction system. The system modification rectified the problem and the SVE system operated as expected (GZA, 1996).

In the 1994 Pre-Design Report for Soil, two sets of cleanup goals were developed for soil at OU2 due to variability in organic carbon content, water content, and lateral groundwater flow rates in different parts of OU2. Zone I was defined as the area to the north of the straight line extending across the Complex, parallel to the north wall of the Elinco Building (see Figure 4-1). Zone II was defined as the area to the south of this line. Table 4-2 contains the soil cleanup standards for Zones I and II that were established by the RP's contractor in the Pre-Design Report for Soil and approved by EPA in 1994.

Figure 4-1. Soil remediation areas, Kellogg-Deering Superfund Site, Norwalk, Connecticut (modified from Tetra Tech, 2002, Figure 4-2).

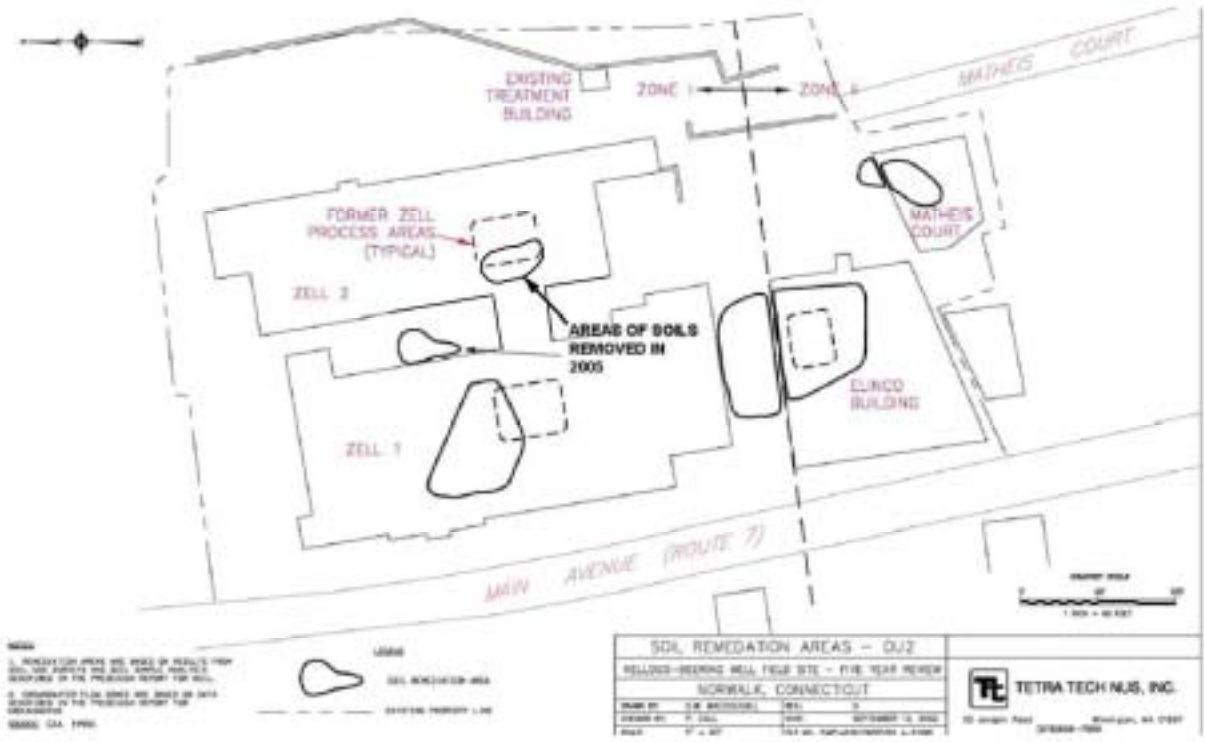


Table 4-3. Soil cleanup standards established in the pre-design workplan for OU2, Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut.

Compound	Soil Cleanup Standards (µg/kg)	
	Zone I	Zone II
Benzene	130	110
Toluene	154,000	141,000
Ethylbenzene	183,000	169,000
1,1,1-TCA	8,300	7,500
1,2-DCA	43	32
PCE	460	420
TCE	180	160
cis-1,2-DCE	1,200	1,000
1,1-DCE	150	130
Vinyl Chloride	38	32
MiBK	4,300	3,500

The SOW outlined the requirements for a sampling and analysis program to be implemented during groundwater remediation to monitor pumping rates in each well, hydraulic gradients in the vicinity of wells, areas of influence produced by individual wells, capture zones, and the progress of contaminant removal from the aquifer. The SOW specified that the PRPs shall remediate groundwater in OU2 until:

- The concentration of each groundwater contaminant is at or below the cleanup standard for the contaminant at every well that is part of the groundwater treatment and monitoring system,
- The concentration of each groundwater contaminant is at or below the cleanup standard for the contaminant at any well that EPA installs for adequate verification that cleanup standards have been achieved,
- The cumulative carcinogenic risk for groundwater falls within the risk range generally considered by EPA to be protective at Superfund Sites, and
- The non-carcinogenic risk does not exceed unity on the Hazard Index." (EPA, 1990).

Nine groundwater extraction wells east of the railroad tracks (3 overburden/6 bedrock) and one bedrock well at the Complex (see Figure 3-2), were installed at OU2 in 1994 and 1995 and pumping tests were performed to determine capture zones and other hydro-geological properties of the system (GZA, 1994, 1996). The groundwater piping network was completed by March 1996. Groundwater treatment system start-up occurred on May 23 and 24, 1996, with the transfer of investigation-derived waste from well development and pump test activities. Initial extraction of groundwater from the well network occurred on May 29, 1996. Monitoring of the groundwater treatment system commenced on May 29, 1996, with the collection of daily influent and effluent samples.

The final Remedial Construction Report (RCR) documenting the installation of the treatment system was submitted to EPA in November 1996. According to this report, official startup and operation of the soil-vapor and groundwater extraction and treatment systems began on September 30, 1996.

Institutional controls restricting the use of groundwater at the Complex have not been implemented through deed restrictions, as required by the 1989 ROD. As discussed in the 1997 ESD, there are no private water supplies at the Site and no risks to the public of exposure to contaminated groundwater. All Site properties are located within 200 feet of the public water supply system. Connecticut laws and regulations strictly regulate drilling of and permits for new water supply wells and provide the requisite institutional controls with respect to groundwater use. Institutional controls to restrict excavation of soil at the Complex have not been implemented as soil cleanup levels have been attained.

4.2.3 OU2—Operation and Maintenance

An O&M plan covering the SVE system, groundwater extraction system and ITS, was submitted by the PRPs in August 1995 along with the Remedial Action Work Plan and Site Management Plan for all OU2 remedial activities (GZA, 1995). In 2005 it was determined that the SVE system should be shut down. The SVE system had not operated since September 2000. Operation of the SVE ceased because of limited mass removal (GZA, 2006). The SVE was dismantled in 2006 as described in the Soil Cleanup Completion Report (GZA, 2006). All soil that exceeded the cleanup goals was excavated and transported to a licensed facility for disposal.

A Field Sampling and Analysis Plan was developed to describe sampling frequency, techniques, and locations that would be used to monitor treatment system progress. The Field Sampling and Analysis Plan included provisions for the collection of soil gas samples from the subsurface at the Complex and the collection of soil samples from locations throughout the remediation area. The purpose of the sampling program would be to periodically assess the effectiveness of the remediation system and to assure that vadose-zone soils have been treated to the cleanup standards that were established in the SOW.

O&M activities during the Five-Year Review Period included routine ITS and groundwater extraction system checks. The ITS is operated and monitored remotely and checked as needed. Samples of the treated groundwater are collected monthly, prior to discharge to the storm sewer, and the results are reported to the CTDEP and in the semiannual ITS Reports. Gas chromatograph (GC) analysis of effluent air from the carbon vessels is conducted monthly to assess compliance with discharge criteria. The carbon vessels are steam regenerated approximately once per quarter. The process generates about 3 drums of organic liquid that are shipped off-site in less than 90 days as a manifested hazardous waste (FOO1, waste TCE). Licensed haulers transport the drums to a RCRA-permitted recycling facility.

The groundwater monitoring program initially included quarterly, annual, and semi-annual sampling of different groups of wells. The results of the quarterly monitoring events were reported in Quarterly Groundwater Monitoring Reports Nos. 1 through 11 (December 1993 – September 1996). Beginning in December 1996, groundwater monitoring was combined into the quarterly ITS reports. The extraction and monitoring wells included in the on-going routine groundwater monitoring are shown on Figure 3-2. Beginning in 2002 monitoring was performed semi-annually in the spring and fall of each year, and the ITS monitoring report was prepared semi-annually.

As shown in Table 4-4, extraction wells, selected SRA wells, and one non-SRA well are included in the semi-annual events. Wells in the Complex, SRA and non-SRA areas along with the extraction wells will

continue to be monitored on an annual and biannual basis as shown in Table 4-4. The approximate locations of the non-SRA wells are shown on Figure 3-2.

Table 4-4. Groundwater monitoring wells sampling frequency for OU2 in 2006, Kellogg-Deering Well Field Site, Norwalk, Connecticut.

	Well Number	Well Type	Semi-Annual	Annual	Biannual
Extraction Wells	EW-4OB	O	X	X	X
	EW-5OB	O	X	X	X
	EW-60B	O	X	X	X
	EW-2	B	X	X	X
	EW-3	B	X	X	X
	EW-4	B	X	X	X
	EW-5	B	X	X	X
	EW-6	B	X	X	X
	EW-7	B	X	X	X
	EW-8	B	X	X	X
	IW-1	B	X	X	X
	IW-2	O	X	X	X
	IW-3	B	X	X	X
	IW-4	B	X	X	X
Complex Wells	ML-6S	S			
	ML-6M	M			
	ML-6D	D			
	ML-7S	S		X	X
	ML-7M	M		X	X
	ML-7D	D			
	MW-3	S			
	MW-100	S			
	MW-101	O			
	MW-104	S		X	X
	MW-106	O		X	X
	K-10	B			X
	MW-1	S			X
	MW-103	S			X
	MW-2	S			X
	K-11	O		X	X
	K-18A	D			
	K-18B	D			
	K-19A	O		X	X
	K-19B	S			
SRA Wells	ML-1S	S		X	X
	ML-1D	D	X	X	X
	ML-2S	S			
	ML-2M	M			
	ML-2D	D			
	ML-3S	S	X	X	X
	ML-3M	M		X	X
	ML-3D	D	X	X	X
	ML-4S	S		X	X
	ML-4M	M			
	ML-4D	D			

Table 4-4 (continued)

	Well Number	Well Type	Semi-Annual	Annual	Biannual
SRA Wells (cont'd)	K-3A	O		X	X
	K-3B	B		X	X
	ML-9	O	X	X	X
	ML-10	O	X	X	X
	ML-11	O	X	X	X
	ML-12S	S	X	X	X
	ML-12M	M	X	X	X
	ML-12D	D	X	X	X
	ML-13S	S	X	X	X
	ML-13M	M	X	X	X
	ML-13D	D	X	X	X
	ML-14S	S	X	X	X
	ML-14M	M	X	X	X
	ML-14D	D	X	X	X
	ML-15	O		X	X
Non-SRA Wells	ML-8S	S		X	X
	ML-8M	M	X	X	X
	ML-8D	D		X	X
	K-A-6A	O		X	X
	K-6B	B		X	X
	K-9B	B		X	X
	K-21	D		X	X
	K-22A	S		X	X
	K-22B	M		X	X
	K-24	D		X	X

Type of Wells: O = Overburden well
B = Open hole bedrock well
S = Shallow bedrock well
M = Medium depth bedrock well
D = Deep bedrock well

Source: GZA, 2007

The annual O&M costs for operating the ITS during 2002-07 averaged about $145,000. Electrical power costs averaged $36,000, and groundwater monitoring costs averaged $90,000 per year. (Jim Clark, GZA GeoEnvironmental, Inc., personal communication, June 2007). When adjusted for inflation, the total annual cost is consistent with "present" (1989) annual average O&M costs of about $101,000 estimated in the ROD.

4.3 OU3—Downgradient Area

As noted above, the management of migration component in the 1989 ROD was separated into two operable units. EPA deferred selection of a remedy for the Downgradient Area in order to be able to evaluate:

- The effectiveness of the Source Area groundwater extraction and treatment system in remediating contamination in the Downgradient Area groundwater,

- Any future data indicating that the contamination plume at the site is having a negative impact on the Norwalk River, and
- Accessibility of the Downgradient Area after the construction of Route 7 is complete.

In 1997, after construction of Route 7, EPA stated in the ESD that further actions would not likely be needed. The ESD also stated, however, that "the final remedial decision regarding the Downgradient Area will not be made until an evaluation of the success of the OU2 treatment system in reducing contaminant concentrations in the groundwater at the Site is performed. If necessary, modifications to the SRA monitoring and remediation system can be made."

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The previous Five-Year Review concluded that the remedial action selected for the Kellogg-Deering Well Field was protective of public health and the environment, and that ongoing maintenance activities of the air stripping facility appeared to be satisfactory to maintain the protectiveness of the remedy (Tetra Tech, 2002).

The following requirements of the OU1 ROD/AO were not being met in 2002 at the time of the last Five-Year Review:

- Sampling of the monitoring wells east of the Norwalk River was not being conducted. EPA determined that since these wells would be sampled as part of the O&M activities for OU2, sampling of these monitoring wells by NFTD was not necessary.

CURRENT STATUS: The six wells located east of the Norwalk River that were to be sampled per the AO have not been sampled since signing of the ROD in 1986. NFTD was not aware of the requirements to collect samples from these wells. However, monitoring wells K-6A, K-6B, K-21, K-22A, K-22B, and K-24 (which are all located east of the Norwalk River between the SRA and OU1) have been sampled yearly since 1993 as part of the O&M for OU2.

- Sampling of air emissions from the air stripping unit was not being conducted, but CTDEP issued an exemption letter stating that the unit did not require an air permit based on the projected maximum emissions.

CURRENT STATUS: According to the CTDEP, this exemption remains valid.

- No QA/QC plan for sampling had been submitted to EPA, QA/QC samples (i.e. duplicates, blanks) were not being collected, and information on sample holding times was not included in the data reviewed. EPA determined that since the two laboratories that analyzed NFTD's VOC samples are certified by the Connecticut DPH, the integrity of the sample analytical results is ensured.

CURRENT STATUS: While NFTD has not prepared and submitted a QA/QC plan to EPA, the objectives of a QA/QC plan are being met. The Regional Water Authority in New Haven, CT, performs complete QA/QC on all samples. The laboratory provides NFTD with sample containers, trip blanks, and any other materials required for quality-control purposes.

- According to NFTD, water samples were being collected from before the stripper and prior to discharge to the public water supply, and not after the stripper, as specified in the AO.

CURRENT STATUS: NFTD continues to collect influent and effluent samples from sampling taps immediately before the stripper and final distribution to the public, respectively. Water samples are not collected after the stripper, but before chlorination, as specified in the AO. NFTD's sampling techniques are consistent with the requirements of the CTDPH.

- The ROD specified yearly inspections of the air stripper, but the maintenance manual for the stripper does not specify an inspection interval.

CURRENT STATUS: NFTD performs daily inspections and preventative maintenance checks, and has a relationship with a contractor that can be contacted if operational issues are observed.

5.1 Protectiveness Statements from Last Review

The 2002 Five-Year Review stated:

that the OU1 remedy for the Kellogg-Deering Well Field was protective of human health and the environment and exposure pathways that could have resulted in unacceptable risks since they were controlled via the wellhead treatment system.

that the remedy at OU2 currently protected human health and the environment in the short term because exposure pathways that could have resulted in unacceptable risks were being addressed through institutional controls that prevented direct contact with contaminated soil, inhalation of contaminated soil vapors, and use of contaminated site groundwater. Groundwater extraction and treatment and periodic SVE treatment continued to occur, but VOC mass removal did not appear to be adequate to achieve the cleanup standards that were established in the ROD. In order for the remedy to be protective in the long-term, a reevaluation of the RAO of restoring the Source Area aquifer to drinking water quality was recommended, as was reconsideration of appropriate soil and groundwater cleanup standards. If necessary, modifications to the remedy were recommended.

that the possibility (of modifying the remedy) was suggested in the 1989 ROD and Proposed Plan: "…EPA would reevaluate the remedy if after an adequate period of performance of the remedy complete restoration of the aquifer is determined to be technically impracticable and that cleanup goals might be readjusted if chemical contaminant concentrations reach a constant value and are no longer being removed at significant levels" (EPA, 1989). At present, the remedy for OU2 is protective in the short term based on the factors noted above. Follow-up actions are necessary to address long-term protectiveness because the RAO to restore groundwater to drinking water quality in the SRA may not be met. A reevaluation of the RAOs and further evaluation of other potential actions and exposure pathways (e.g. vapor intrusion pathway) is recommended.

that the remedy at OU3 was currently protected human health and the environment because State institutional controls were in place to prevent the use of contaminated groundwater. Despite elevated concentrations of VOCs in groundwater in OU3, continued remedial activities at OU2, including possible modifications to the SRA monitoring and remediation system, were expected to protect human health and the environment in the Downgradient Area.

5.2 Status of Recommendations and Follow-Up Actions from the Last Review

Following is a summary of recommendations and follow-up actions for the three operable units from the 2002 Five-Year Review.

5.2.1 OU1—Kellogg-Deering Well Field

The 2002 Five-Year Review recommended that NFTD continue operation of the air stripper to protect against potential future migration of VOCs into the well field from the Downgradient Area. It also suggested that the AO between NFTD and EPA be modified to declare the remedy complete. This would allow the State of Connecticut, rather than EPA, to oversee the performance of the wellhead treatment system at OU1. The air stripper continues to operate and removes all of the VOCs to below detection levels.

5.2.2 OU2—Source Remediation Area

The 2002 Five-Year review recommended that RAOs for groundwater be reevaluated to assess the technical practicability of restoring the aquifer to drinking water quality. The technical practicability assessment may involve a comprehensive review of historical VOC concentrations and concentrations trends in groundwater samples collected since implementation of the remedy. The comprehensive review of VOCs was not implemented.

An evaluation of contaminants in soils led to the dismantling of the SVE system and excavation of soils in two remaining "hot spots." The locations of soils excavated are shown in Figure 4-1.

5.2.3 OU3—Downgradient Area

The 2002 Five-Year Review stated that elevated concentrations of VOCs detected in monitoring wells in the Downgradient Area and within 200 feet of the Norwalk River may be appropriate to trigger a reassessment of the need for remedial action in OU3. In the meantime, groundwater sampling at selected locations in the Downgradient Area should continue on at least an annual basis as part of the ongoing O&M for OU2.

EPA and CTDEP believe that a further investigation of shallow groundwater in OU3 is warranted to evaluate the risk of vapors migrating into buildings from groundwater polluted with VOCs. Groundwater monitoring continued in the Downgradient Area, but the need for remedial action was not reassessed. Monitoring currently is limited to a few wells that may not represent conditions throughout the OU3 area.

6.0 FIVE YEAR REVIEW PROCESS

This section provides a summary of the Five-Year Review process and the actions taken by EPA to complete this fourth Five-Year Review.

6.1 Administrative Components

EPA, the lead agency for this five-year review, notified CTDEP and the PRPs in early Spring 2007 that the five-year review would be completed. Support was provided by Leslie McVickar, the EPA Remedial Project Manager for the Kellogg-Deering Site. USACE personnel that contributed to this review included Forest Lyford, Geologist, Ian Osgerby, Chemical Engineer, Larry Cain, Risk Assessor, and Tracy Dorgan, Geologist. Forest Lyford and Ian Osgerby conducted the site visit on May 29-30, 2007.

In March 2007, the review team established the work plan and review schedule whose components included:

- Community Involvement
- Document Review
- Data Review
- Site Inspection
- Local Interviews; and
- Five-Year Report Development and Review

6.2 Community Involvement

EPA issued a press release announcing EPA's review of the progress of the Kellogg-Deering Well Field Site cleanup. The press release encouraged public participation. Public involvement in the site has been minimal since the mid-1980s.

6.3 Document Review

This five-year review consisted of a review of relevant documents including decision documents and monitoring reports.

6.3.1 Background Documents Review

Site-related documents reviewed as part of this effort are included in the list of references in Section 12.

6.3.2 Review of ARARs

Applicable or Relevant and Appropriate Requirements (ARARs) for the Kellogg-Deering Well Field Superfund Site were identified in the ROD for OU1 (EPA, 1986) and for OU2 (EPA, 1989) and include the following:

- Clean Water Act (CWA)
- Safe Drinking Water Act (SDWA)
- Federal Executive Order 11990 (Protection of Wetlands)
- State of Connecticut Groundwater Quality Standards
- State of Connecticut Standards for Public Drinking Water Quality
- State of Connecticut Surface Water and Wetlands Regulations
- Resource Conservation and Recovery Act (RCRA)

- Closure/Post Closure Requirements for Hazardous Waste Facilities
- State of Connecticut Hazardous Waste Management Requirements
- State of Connecticut Control of Noise Regulations
- State of Connecticut Regulations for the Well Drilling Industry
- Federal Clean Water Regulations governing activities in Wetlands

Additionally, the ROD identifies the following as "To-Be Considered" (TBCs) criteria:

- Federal Drinking Water Health Advisories
- Federal Groundwater Protection Strategy
- Federal Groundwater Use and Value Determination

Cleanup goals for the groundwater and soil at the Kellogg-Deering site were presented above in Tables 4-1, 4-2 and 4-3. During the second five year period, no changes were implemented in the State of Connecticut or federal drinking water regulations that served as the basis for the interim cleanup goals. With respect to site-related contaminants of concern (COCs) in groundwater, no changes have been promulgated since 1997 in the Federal Maximum Contaminant Concentrations (MCLs) under the SDWA.

No pertinent technical changes to relevant and appropriate portions of RCRA (40 CFR 264 Subpart G), were enacted since the signing of the ROD. The only changes made to this subpart of the RCRA regulations include: (1) giving the governing agencies the ability to use a variety of authorities to impose requirements based on the particular facility; (2) modifications to the regulations to allow facilities to address certain units through the corrective action program; and (3) specification of Part B information submission requirements for facilities that receive post-closure permits.

State of Connecticut regulations governing well drilling industry and noise generation are applicable during the installation of additional monitoring wells. At this time there are no plans for such activities. Therefore, requirements associated with these regulations are not applicable at this time.

State of Connecticut Hazardous Waste Management Requirements were subject to revisions finalized on June 25, 2002. None of these changes impact the remedy being implemented at the Site. Notable changes to the regulations include: (1) changes to the standards for used oil generators, transporters, processors, re-refiners, burners and marketers; (2) the universal waste rule, which established reduced management requirements for hazardous waste batteries, thermostats, pesticides and lamps; and (3) the addition of used electronics to the State's universal waste rule. None of these changes impact the remedy being implemented at the Site. ARARs and TBCs are summarized in Appendix B.

6.3.3 Toxicity and Chemical Characteristics

Examination of the EPA's Integrated Risk Information System (www.epa.gov/iris) indicates no change to the toxicity values assigned to COCs identified in the 1986 and 1989 Records of Decision. This means that the cleanup goals remain protective.

6.4 Data Review

Various RP-contractor monitoring reports and plans were reviewed to assess contaminant levels and relevant trends that may be indicative of remedy performance. A summary of data regarding the components of the Site remedy is presented below.

6.4.1 OU1—Kellogg-Deering Well Field

Quarterly influent and effluent sampling data for the OU1 treatment system for May 2002 to November 2006 were provide by the NFTD (Michael Elliot, written communication, May 2007). Quarterly influent water samples from May 2002 to November 2004 had TCE concentrations that ranged from not detected to 2.4 µg/L (May 1, 2002). Influent analyses are not available for the period from March 2005 to November 2005. TCE was not detected in treated water during the five-year review period. Selected VOCs that were detected are summarized in Table 6-1.

Table 6-1. Groundwater influent concentrations since last five-year review, OU1 treatment system, Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut.

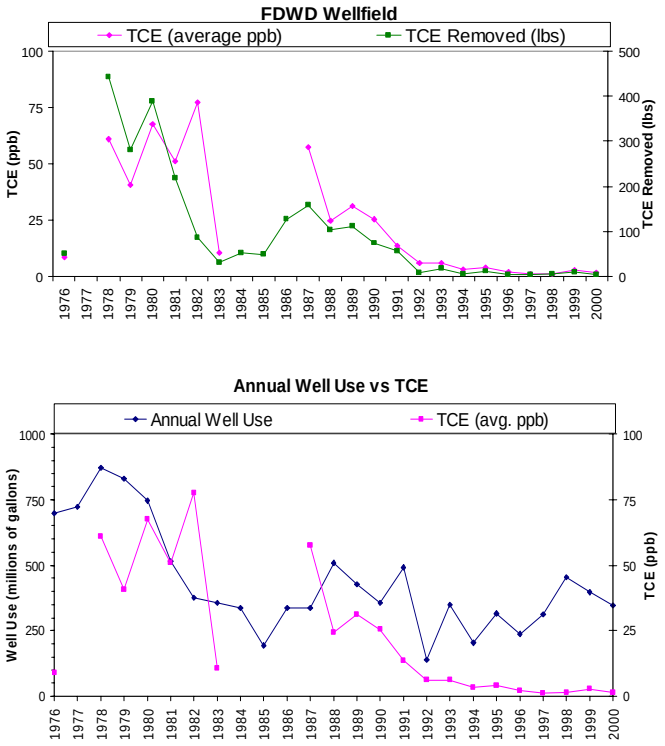
Sampling Date	PCE (µg/L) [MCL = 5 µg/L]	TCE (µg/L) [MCL = 5 µg/L]	cis-1,2-DCE (µg/L) [MCL = 70 µg/L]
5/1/2002	**0.7**	**2.4**	**2**
8/20/2002	ND	**0.5**	ND
11/6/2002	ND	**1.6**	**1.4**
2/10/2003	ND	**1.2**	**0.5**
5/7/2003	ND	**0.7**	ND
8/5/2003	ND	ND	ND
11/3/2003	ND	ND	ND
2/3/2004	ND	ND	ND
5/4/2004	ND	ND	ND
8/18/2004	ND	**0.5**	ND
11/3/2004	**0.5**	**0.9**	**0.8**
3/2/2005	NS	NS	NS
5/4/2005	NS	NS	NS
7/19/2005	NS	NS	NS
8/5/2005	NS	NS	NS
11/9/2005	NS	NS	NS
11/29/2005	ND	NS	**0.5**
12/7/2005	ND	NS	ND
12/7/2005	ND	NS	ND
12/14/2005	**0.8**	NS	**1.9**
2/1/2006	NS	NS	NS
5/17/2006	NS	NS	NS
8/9/2006	NS	NS	NS
11/20/2006	NS	NS	NS
3/14/2007	NS	NS	NS
1/30/2007	NS	NS	NS

ND: Not detected; reporting limits not available.
NS: Not sampled

During the site visit with NFTD personnel, George Fulton, NFTD Engineer, stated that the declining trends in VOCs were observed in the Well Field at least two years before the treatment system began operating at OU2 in 1995. Later he stated in a phone conversation that the declines appeared to coincide with the cessation of disposal activities at OU2. Graphs on Figure 6-1 show a declining trend in TCE concentrations starting in 1988. By 1992, the trend had nearly stabilized at TCE concentrations below 10 µg/L. The cause for decline is not known but may relate, in part, to total well field pumpage. The 1986 ROD stated that Layne 1 was pumped to waste to control concentrations of TCE at the other wells. George Fulton, in a phone conversation on July 2, 2007, confirmed that the well was pumped to waste at

a rate of about 2,800 gallons per minute from about 1980 to 1988. Pumping ceased in 1988 with installation of the air stripper. This pumpage is not reflected in the graphs on Figure 6-1, but may have caused expansion of the well-field contributing area into the contaminant plume on the east side of the river. A numerical model that was constructed to assess contributing areas to public supplies demonstrated that the contributing area for maximum allowable pumping rates extends into the OU3 area (Milone & MacBroom, Appendix E).

Figure 6-1. Annual well use, average TCE concentrations, and TCE removal at the Kellogg-Deering Well Field (OU1), 1976-2000 (data provided by NFTD, May 2007).



6.4.2 OU2—Source Remediation Area

Semi-annual ITS reports were reviewed for the source control and groundwater remedies for OU2. Analytical data from groundwater samples, groundwater treatment system influent and effluent samples, and soil samples were reviewed. Mass removal calculations for the ground-water treatment system also were reviewed. The following sections provide a description of relevant data for the review period.

6.4.2.1 Groundwater Analytical Data

Monitoring wells are grouped as follows in the data reports.

- Extraction wells for groundwater treatment,
- Monitoring wells located within the Complex, and
- Monitoring wells located within the SRA (between Main Avenue and the railroad tracks).

TCE is the principal COC in groundwater and has the highest concentrations. Concentration trends for TCE in groundwater samples represent general trends for the other VOCs that are analyzed as part of the groundwater treatment system monitoring program. Since 1999, TCE concentrations in samples collected from most extraction wells have decreased noticeably, but trends are not obvious for wells EW-3, EW-4, IW-2, and IW-4 (Figure 3-2). Ranges of concentrations of TCE, PCE, and cis-1,2-DCE, which are the main VOCs in groundwater, for 2002-2006 are summarized in table 6-2. Also shown are concentrations for September 2006. Other VOCs have not been detected above reporting limits. Reporting limits typically range from 5 to 10 µg/L for most chemicals.

Table 6-2. Summary of TCE, PCE, and cis-1,2-DCE concentration ranges in groundwater, for 2002-2006 and concentration in September 2006, Kellogg-Deering Well Field SuperfundSite, Norwalk, Connecticut (from GZA, 2007, tables E1, E2, E3).

Chemical		TCE (µg/L) Goal = 5 µg/L		PCE (µg/L) Goal = 5 µg/L		cis-1,2-DCE (µg/L) Goal = 70 µg/L	
Well Number	Sampling Frequency	Range 2002-2006	Sept. 2006	Range 2002-2006	Sept. 2006	Range 2002-2006	Sept. 2006
ML-6S	NS						
ML-6M	NS						
ML-6D	NS						
ML-7S	A	280-480	480	46-100	100	2.4-5.6	5.6
ML-7M	A	3,800-6,800	3700	370-530	370	70-88	88
ML-7D	NS						
IW-1	SA	290-5,600	290	22-260	22	73-2,400	73
IW-2	SA	1,500-4,300	4300	99-340	310	110-1,500	1500
IW-3	SA	1,300-8,500	6700	230-1,400	530	<50-6,800	2300
IW-4	SA	2.2-2,400	1600	<1.0-130	17.0	0.25-130.0	130.0
EW-2	SA	190-930	930	3.6-19.0	19.0	170-1000	1000
EW-3	SA	140-1,200	980	3.0-14.0	14.0	200-1,600	650
EW-4	SA	2,300-6,900	4200	26-84	49	130-790	710
EW-4OB	SA	42-3,300	42	3-300	3	10-1,900	10
EW-5	SA	11-470	38	<1.0-18	1.9	1.8-110	20
EW-5OB	SA	2.5-24	24.0	0.2-0.9	0.9	0.8-11.0	11.0
EW-6	SA	11-1,300	34	<1.0-1.8	1.0	12-440	26
EW-6OB	SA	21-3,800	26	1-81	1	11-700	11
EW-7	SA	200-1,200	1200	13-46	21	16-440	440
EW-8	SA	14,000-21,000	20,000	<250-980	820	690-1,900	1,900
MW-1	AL	<1.0-0.3	0.3	<1.0	<1.0	<1.0	<1.0
MW-2	AL	29-57	57	1.6-2.8	2.8	1.5-2.4	2.4
MW-3	NS						
MW-100	NS						
MW-103	AL	42-66	66	7.0-12	12	<1.0	<1.0
MW-104	A	380-600	600	12-21	21	2.0-5.7	2.0
MW-106	A	<1.0-0.9	0.9	<1.0	<1.0	0.2-<1.0	<1.0
K-10	AL	16-71	71	0.33-1.4	1.4	7.0	7.0
K-11	A	10-51	30	4.4-9.4	4.4	3.5-12	9.5
K-18A	NS						
K-18B	NS						
K-19A	A	10-54	54	1.7-7.1	2.0	0.4-0.95	0.68

Chemical		TCE (µg/L) Goal = 5 µg/L		PCE (µg/L) Goal = 5 µg/L		cis-1,2-DCE (µg/L) Goal = 70 µg/L	
Well Number	**Sampling Frequency**	**Range 2002-2006**	**Sept. 2006**	**Range 2002-2006**	**Sept. 2006**	**Range 2002-2006**	**Sept. 2006**
K-19B	NS						
ML-1S	A	0.5-4	0.5	<1.0	<1.0	0.4-1.6	<1.0
ML-1D	SA	<1.0-840	4.1	<1.0-10	<2.5	30-810	370
ML-2S	NS						
ML-2M	NS						
ML-2D	NS						
ML-3S	SA	5.4-170	170	<1.0-7.1	7.1	1-271	271
ML-3M	A	98-960	960	1.9-<25	10.0	60-480	230
ML-3D	SA	980-2,200	1,300	<10-<50	<50	1,800-2,300	2,200
ML-4S	Var	340-710	710	8.7-18	18	56-76	76
ML-4M	NS						
ML-4D	NS						
ML-8S	A	11-23	21	0.23-<1.0	<1.0	2.9-5.3	3.7
ML-8M	SA	29-64	58	<1.0	<1.0	5.7-9.2	7.9
ML-8D	A	1.9-220	220	<1.0-1	1	3.1-8.2	8.2
K3A	A	3-52	52	5.0-35	18	1.0-13	13.0
K3B	A	2.9-55	55	1.9-5.5	5.5	1.0	16.0
ML-9	SA	<1.0-21.0	21.0	0.3-<1.0	0.3	<1.0-5.3	1.3
ML-10	SA	<1.0-43	15	0.4-0.8	0.8	<1.0-4.0	2
ML-11	Var	4.7-6	5.0				
ML-12S	SA	<1.0-5.2	2.9	<1.0-<5.0	<1.0	17-130	25
ML-12M	SA	1.8-1,900	1,900	<1.0-12	12	7.3-340	60
ML-12D	SA	<1.0-19.0	19.0	<1.0-<5.0	0.35	83-140	83
ML-13S	SA	<1.0-30.0	30.0	0.31-2.9	0.52	<1.0-5.5	5.4
ML-13M	SA	18-54	25	<1.0-1.4	0.68	37-73	54
ML-13D	SA	<1.0-54	4.0	<1.0-5.0	<2.5	<1.0-170	150
ML-14S	SA	1.8-140.0	140.0	<1.0-4.5	4.5	0.5-11	11
ML-14M	SA	210-860	820	6.8-	28.0	220-670	220
ML-14D	SA	620-1,300	1000	<5.0-32	32	320-3,600	320
ML-15	Var					1.0-2.4	2.4
K-6A	NS						
K-6B	A	52.0-100	52.0	1.4-2.5	1.4	76-110	99
K-9B	A	7.1-39	7.3	0.4-1.8	<1.0	24-84	24
K-21	A	890-1,300	890	6.7-<25	<25	320-480	350
K-22A	A	<1.0-91.0	91.0		Var	<1.0	0.57
K-24	Var					3.1-2,400	33

Goal = Groundwater cleanup goal from ROD for OU2
NS = Not Sampled
A = Annually
SA = Semi Annually
AL = Alternating Years
Var =Variable
Reporting limits are variable

In general, cleanup goals for TCE, PCE, and cis-1,2-DCE in groundwater have not been achieved. In September 2006, the concentrations of TCE, PCE, and cis-1,2-DCE were orders of magnitude greater than cleanup goals established in the ROD (Table 4-3).

6.4.2.2 Groundwater Treatment System Analytical Data

Treatment system samples are collected monthly from influent and effluent sampling ports within the ITS treatment building, and analyzed for VOCs. Influent TCE concentrations have remained fairly steady since February 2002, fluctuating around an average concentration of about 1,000 µg/L (Table 6-3). Cis-1,2-DCE concentrations have likewise remained fairly steady, fluctuating around an average of about 300 µg/L.

Table 6-3. Summary of groundwater treatment system influent and effluent sampling, 2002-2006, Kellogg-Deering Well Field Site, Norwalk, Connecticut.

Date	TCE (µg/L)		PCE (µg/L)		Cis-1,2-DCE (µg/L)	
	Influent	Effluent (CTDEP limit = 5 µg/L)	Influent	Effluent (CTDEP limit = 5 µg/L)	Influent	Effluent (no limit specified)
1/15/02	3,300	ND	91	ND	1,200	ND
2/28/02	1,200	ND	ND	ND	510	ND
3/26/02	1,200	ND	ND	ND	360	ND
4/11/02	1,900	ND	56	ND	360	ND
5/29/02	610	ND	27	ND	200	ND
6/13/02	410	ND	18	ND	250	ND
7/10/02	620	ND	33	ND	280	ND
8/15/02	1,000	ND	34	ND	380	ND
9/20/02	1,200	ND	26	ND	310	ND
10/4/02	680	ND	13	ND	210	ND
11/18/02	770	ND	27	ND	280	ND
12/9/02	910	ND	23	ND	240	ND
1/16/03	760	ND	29	ND	180	ND
2/25/03	1,100	ND	29	ND	360	ND
3/11/03	1,400	ND	40	1	360	ND
4/21/03	1,600	ND	32	ND	370	ND
5/27/03	1,100	ND	33	ND	380	ND
6/11/03	1,100	1.8	34	ND	360	ND
7/2/03	1,100	1.6	34	ND	250	ND
8/11/03	660	ND	22	ND	120	ND
9/18/03	1,400	ND	46	ND	510	ND
10/28/03	700	<1.0	22	<1.0	200	<1.0
11/25/03	1,000	<1.0	24	<1.0	320	<1.0
12/10/03	1,400	<1.0	42	<1.0	220	<1.0
4/12/04	1,300	<1.0	43	<1.0	500	<1.0
5/4/04	900	<1.0	18	<1.0	230	<1.0
6/22/04	680	160	17	4.8	200	5.7
7/2/04	1,100	<1.0	29	<1.0	590	<1.0
7/21/04	1,300	<1.0	61	<1.0	610	<1.0
8/30/04	370	<1.0	16	<1.0	110	<1.0
9/15/04	1,400	<1.0	45	<1.0	360	<1.0
10/13/04	760	<1.0	31	<1.0	190	<1.0
11/29/04	1,500	<1.0	<10	<1.0	410	<1.0
12/20/04	740	<1.0	23	<1.0	260	<1.0

1/13/05	820	<1.0	<5.0	<1.0	260	<1.0
2/11/05	870	<1.0	27	<1.0	310	<1.0
3/10/05	890	<1.0	12	<1.0	280	<1.0
4/13/05	440	<1.0	33	<1.0	150	<1.0
5/9/05	1,000	<1.0	22	<1.0	540	<1.0
6/23/05	950	<1.0	24	<1.0	430	<1.0
7/13/05	810	<1.0	19	<1.0	330	<1.0
8/8/05	960	<1.0	<10	<1.0	550	<1.0
9/19/05	600	<1.0	<10	<1.0	250	<1.0
4/26/06	670	<1.0	<25	<1.0	240	<1.0
5/22/06	780	<1.0	21	<1.0	250	<1.0
6/15/06	1,300	<1.0	47	<1.0	320	<1.0
7/3/06	810	<1.0	<50	<1.0	200	<1.0
8/8/06	780	<1.0	28	<1.0	380	<1.0
9/29/06	850	<1.0	30	<1.0	450	<1.0

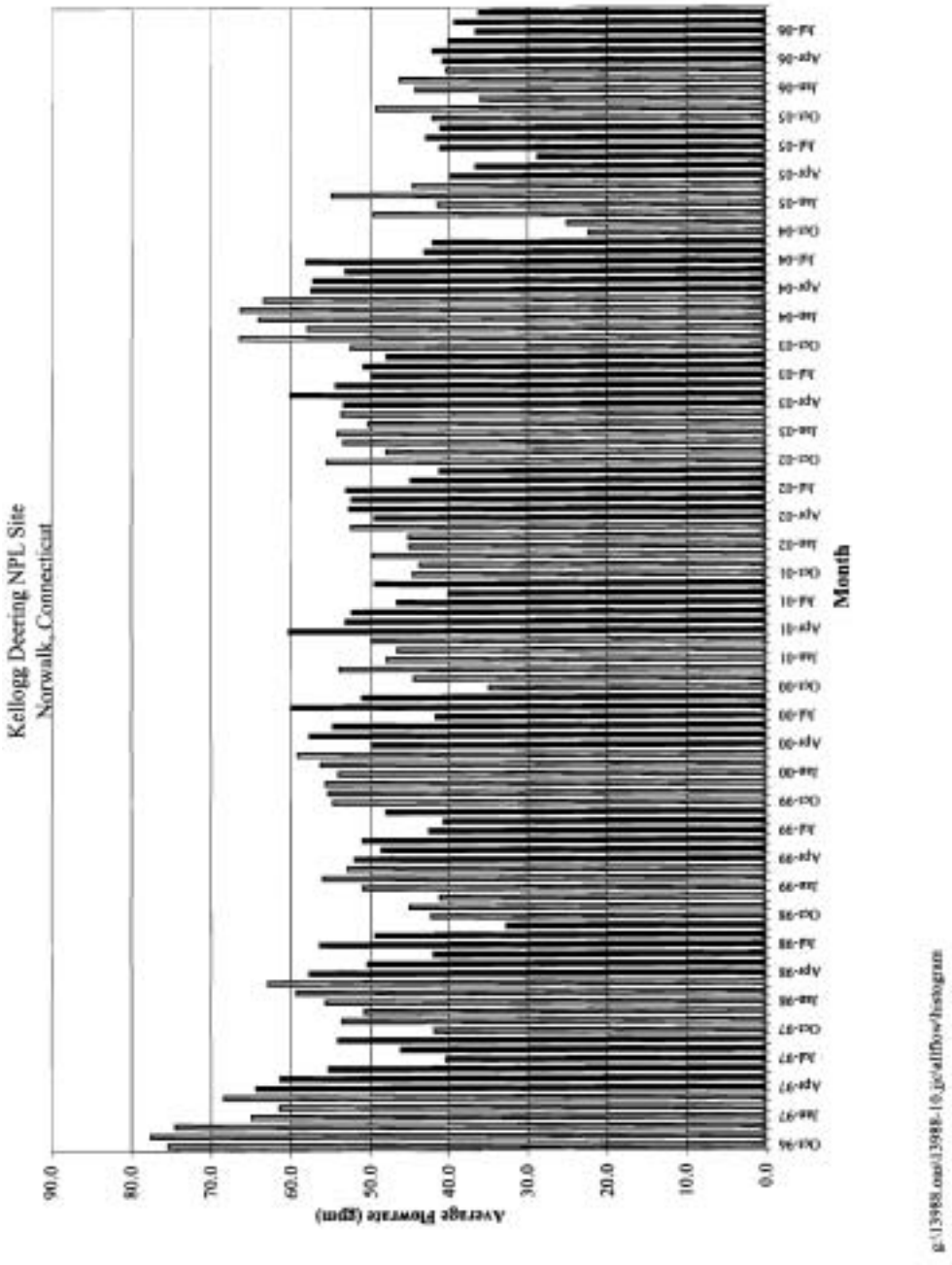
Note: Reporting limit is variable; ND, the reporting limit was not available for this review.

In February 2005, CTDEP issued a general permit for the discharge of groundwater remediation wastewater directly to surface water. At the request of CTDEP, BZA submitted an application to register the system discharge under this general permit in December 2005. CTDEP accepted this application and issued a certificate of registration for the system discharge (Permit No. GRS000022). The general permit requires monthly effluent sampling for VOCs and quarterly sampling for aquatic toxicity (GZA, 2007). TCE was detected in effluent samples three times, and PCE was detected in effluent samples twice during the review period. Cis-1,2-DCE has been detected in an effluent sample only once. The table indicates that treated water discharged to the storm sewer routinely meets discharge limits established by CTDEP. An exception was for TCE on June 22, 2004.

6.4.2.3 SVE System Air Sample Analysis

The SVE component of the ITS has not operated since 2005 when the system was dismantled.

Figure 6-2. Summary of groundwater extraction system average monthly flow rates, Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut (chart from GZA, 2007)



6.4.2.4 VOC Mass Removal

Groundwater VOC mass removal rates for individual wells are calculated using total VOC concentrations collected during quarterly sampling events (Section 6.4.2.1) and average groundwater extraction rates collected during the operation of the ITS. Individual well VOC removals are then totaled to estimate the total VOC removal for the groundwater treatment system. Table 6-4 provides a summary of semiannual VOC mass removal for the groundwater treatment system since 2002. Mass removal rates have remained fairly steady. Declines in 2005 and 2006 may reflect a declining pumping rate (Figure 6-2). For the ITS operation period, approximately 5,815 pounds (528 gallons) of VOCs have been removed by the groundwater extraction system (GZA, 2007).

Table 6-4. Estimated semiannual VOC mass removed from groundwater at OU2, 2002-2006, Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut.

Date	Estimated Semiannual VOC Mass Removed from Groundwater (pounds)
January 2002 – June 2002	100
October 2002 – March 2003	180
April 2003 – September 2003	100
October 2003 – March 2004	100
April 2004 – September 2004	130
October 2004 – March 2005	100
April 2005 – September 2005	190
October 2005 – March 2006	90
April 2006 – September 2006	70

6.4.2.5 Soil Removal

Soils data from an intensive soil-sampling program in and near buildings of OU2 during April 2004 provided a basis for revising soil cleanup standards. Leachate-based standards were redefined for two zones (Figure 4-1) because of different soil properties. The cleanup goals are summarized in Table 6-5.

The sample results indicated that PCE concentrations in a localized area of the Courtyard between the Zell 1 and Zell 2 buildings and TCE concentrations in the Zell 2 building (Figure 4-1) were above site-specific leachate standards and risk-based standards. Soils in these two areas were excavated and removed from the site in October 2005. GSA (2006) concluded that the leachate-derived cleanup criteria have been achieved for both Zones and for all compounds of concern. EPA concurred that "the cleanup standards for the soil vapor extraction system have been met" in a letter of May 8, 2006 (GZA, 2007).

Table 6-5. Revised Soil cleanup goals for OU2, Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut.

	Cleanup Goals (µg/KgSoil)	
	Zone I	Zone II
TCE	7,959	6,758
PCE	15,103	12,911

1,1,1-TCA	8,300	7,500
Cis-1,2-DCE	1,200	1,000
Benzene	130	110
Toluene	154,000	141,000
Ethylbenzene	183,000	169,000
1,1-DCE	150	130
1,2-DCA	43	32
Vinyl Chloride	220	

6.4.2.6 Vapor Intrusion Pathway

No assessment of vapor intrusion pathways to occupied buildings in OU2 has been performed.

6.4.3 OU3—Downgradient Area

6.4.3.1 Groundwater

Groundwater from wells located in OU3 has been sampled and analyzed annually by the RP's contractor. During the most recent sampling round (September 2006), TCE, PCE, 1,2-DCE (cis and trans), and vinyl chloride were detected in groundwater samples. Table 6-2 summarizes ranges of concentration for TCE, PCE, and cis-1,2-DCE for the K-labeled wells in OU3 for June 2002 to September 2006. Concentrations of TCE, cis-1,2-DCE, and vinyl chloride in groundwater samples collected from OU3 exceeded MCLs. TCE concentrations detected in groundwater samples collected from wells in the Downgradient Area are presented on Table 6-6.

Table 6-6. TCE Concentrations in groundwater in downgradient area (OU3), December 1999 – September 2006, Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut (Data from GZA, Table E.1).

Monitoring Well No.	TCE (µg/L) Dec-99	TCE (µg/L) Dec-00	TCE (µg/L) Dec-01	TCE (µg/L) Sept-02	TCE (µg/L) Sept-03	TCE (µg/L) Sept-04	TCE (µg/L) Sept-05	TCE (µg/L) Sept-06	Average for Last 3 Rounds
K-6B	160	100	100	78	100	89	70	52	70
K-9B	130	88	69	22	39	16	7.1	7.3	10
K-21	2,100	1,800	1,200	1,000	1,200	1,300	1,300	890	1,163
K-22A	2.4	1.9	3.6	<1.0	<1.0	<1.0	<1.0	91	31
K-24	NS	44	6.2	19	3.9	1100	36	NS	380

Concentrations of VOCs in OU3 appear to be declining through natural attenuation, but are still considerably higher than MCLs. Vinyl chloride concentrations of 5.9 µg/L in water from well K-6B and 0.2J (below the reporting limit) in well K-9B in the fall of 2006 indicate some biodegradation in the Downgradient Area near the Norwalk River. The highest TCE concentrations in OU3 were detected in a groundwater sample collected from monitoring well K-21, where declining concentrations are not apparent. Vinyl chloride was not detected in this well at a reporting limit of 25 µg/L. Previous studies have indicated that this well intercepts a fracture zone that can yield more that 50 gallons per minute (gpm) and may be along a dominant pathway for contaminants from OU2. The high concentrations may persist where pumping from the ITS system has created an area of minimal hydraulic gradient (a

stagnation zone) between the cone of depression and the ambient gradient to the southwest. More water-level data are needed to determine if a stagnation zone is present near well K-21.

6.4.3.2 Vapor Intrusion Pathway

A Phase I vapor intrusion sampling study was conducted in May 2006 in OU3. The objective of the study was to evaluate potential vapor intrusion pathways within the OU3 area, specifically the residential area that is bounded by Broad Street, Davis Street, Slocum Street, and Muller Avenue (Figure 3-1). Results of the study were summarized by Tetra Tech NUS (2006) in a draft report. Sampling was performed using a direct push technology along streets and public right of ways. Target depths were 9.5 to 10 feet, but refusal commonly limited sampling to shallower depths. Although ground-water sampling was one objective, no ground water was encountered. The depth to groundwater in this area typically exceeds 30 feet (Figure 3-3).

The highest TCE concentrations of 440 and 485 parts per billion by volume (ppb/v) were detected in soil gas samples collected at two locations near the intersection of Sniffen and Broad Street. TCE concentrations, were detected at six locations, exceeded EPA target concentrations (cancer risk = 10-5). PCE was detected at one location, where the EPA target concentration was exceeded. EPA plans to complete a Phase II study to include soil gas and indoor air sampling at six areas in the Phase I study area in 2008.

6.5 Site Inspection

A site inspection was conducted on May 29-30, 2007, by Ian Osgerby and Forest Lyford, USACE. The inspection of the Source Remediation Area, OU2 on May 29 included Jim Clark and Dave Rusczyk, GZA, Jane Warren, attorney for the owner of the Zell 1, Zell 2 and Elinco buildings (and land upon which these buildings are situated) , and Don Stever, attorney for the PRPs. The inspection of the Well Field, OU1, included a meeting on May 29 with several personnel for NFTD, Jane Warren and Don Stever. Mike Elliot and Tracey Pierson guided a tour of the well field (OU1) on May 30. Further discussions were held with Graham Stevens (CTDEP), NFTD personnel, Jane Warren, and Don Stever on May 30.

The Zell 1, Zell 2 and Elinco buildings (fig. 4-1) were demolished after the site visit. The cement floors remain.

The treatment system is largely automated, but is checked monthly by the PRP's contractor and as otherwise needed. All equipment and instrumentation is wired to a central programmable logic controller within the treatment building. At the time of the site visit, a power failure had caused a shutdown of the system. The cause of the power failure was corrected and the system was fully operational by May 30.

The Complex is surrounded predominately by commercial businesses. There are a few private homes interspersed with businesses along Main Avenue. An assisted living facility is located just north of the Complex. All of the SRA wells are flush with the pavement and protected by either road boxes or manhole covers.

On May 29, USACE personnel drove around OU3. This area is primarily residential, but several businesses are in buildings north of Muller Avenue and along the northern extension of Sniffen Street. A cemetery and commercial businesses are along Broad Street. Route 7, a four-lane divided highway, passes through OU3. This part of Route 7 was constructed before the OU2 remedy was started in 1997.

NFTD personnel described the treatment system during the inspection of the well field. Plans are to dismantle the original air stripper that was constructed in the 1970s. A major storm in April flooded the area around the wells, and flood debris was observed along the shoreline of Kellogg Pond. NFTD personnel stated during the meeting on May 29 that an application has been filed with Connecticut Department of Health for a backup well. Copies of materials that had been provided to the Department of Health were also given to USACE personnel.

6.6 Interviews

The Five-Year Review Process requires interviews with representatives of EPA, CTDEP, the City of Norwalk, and representatives of the Potentially Responsible Parties (PRPs). Interview Record forms are provided in Appendix A.

Generally, the interviews indicated that implementation of the selected remedy has proceeded without significant issue or concern. A representative of the Town stated that there have essentially been no inquiries or complaints regarding the site and the associated activities Graham Stevens (CTDEP), Lori Mathieus (CTDPH), and George Fulton (NFTD) all expressed concern about the fate of contaminants that persist in the OU3 area.

NFTD personnel stated that a Level A (wellhead protection) analysis had been performed for the well field and submitted to CTDEP for review. A map that shows the wellhead protection area was provided during the interview. The map shows that the Level A area includes the three operable units. A copy of the map is included in Appendix C.

7.0 TECHNICAL ASSESSMENT

7.1 Technical Assessment Questions

This section addresses the following three technical assessment questions identified in the EPA's Five-Year Review guidance document:

Question A: *Is the remedy functioning as intended by the decision documents?*

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?*

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

The following sections address each question for OU1 and OU2.

7.1.1 OU1—Kellogg-Deering Well Field

7.1.1.1 Question A: Is The Remedy Functioning As Intended By The Decision Documents?

The review of documents, ARARs, site inspection notes, and quarterly water sampling results indicate that the remedy is functioning as intended by the ROD. The Well Field treatment system continues to operate as designed, and samples of groundwater collected immediately prior to discharge to the distribution system indicate that the air stripper is removing VOCs from the public water supply. As a result, the remedy is accomplishing the RAO established in the ROD to "assure a reliable supply of safe, potable water to the public dependent on the well field."

The operation and maintenance of the air-stripping tower at OU1 has become incorporated into NFTD's regular operations for the well field. Information collected during the site inspection indicates that the treatment system is being operated and maintained efficiently, and no changes or improvements are recommended at the time of this five-year review.

Perimeter fencing controls access to the well field. As part of a GAA groundwater classification area, private wells are prohibited in the vicinity of the well field.

7.1.1.2 Question B: Are The Exposure Assumptions, Toxicity Data, Cleanup Levels, And Remedial Action Objectives (RAOs) Used At The Time Of The Remedy Selection Still Valid?

Changes in Standards and TBCs. Current chemical-specific ARARs that are applicable to OU1 include federal and state drinking water standards and state air emissions regulations. Interim cleanup goals for the aquifer at the Kellogg-Deering site are based on ARARs. As noted in Section 6.3.1 (Review of ARARs), federal drinking water standards (MCLs) have not changed since the last five-year review. A summary of current drinking water standards and drinking water standards at the time of the last five-year review for COCs is presented below in Table 7-1. Because no changes have been made to the federal or state MCLs, the protectiveness of the goals selected in the remedy remains unchanged. Tables X below indicates that although several additional or alternative standards have been promulgated by the State of Connecticut, none of them affect the protectiveness of the remedy.

Table 7-1. Additional or Alternative ARARs During the Five Year Review Period for Kellogg-Deering Superfund Site

Medium	Contaminants of Concern with ARARs	ARAR per ROD	Basis of ARAR	Current CT Regulation	Additional or Alternative CT Criteria	Implication for ARAR
Groundwater (µg/l)	1,1-Dichloroethene	6	CT Vol. Criteria (Industrial/Commercial)	6	190 (Residential)	"Res GWVC" criteria added 12/16/03 but original ARAR is more stringent and remains unchanged
	1,2-Dichloroethene	70	CT GWPC	70	10,300	"I/C GWVC" criteria added 3/6/03 for cis-12DCE but original ARAR is more stringent and remains unchanged

GWPC - Connecticut Groundwater Protection Criteria for drinking water
Additional or Alternative Criteria are published by CT in a list of revisions
GWVC and Vol. Criteria - Connecticut Volatilization Criteria for groundwater that is protective of indoor air quality

CTDEP issued an exemption letter to NFTD in July 1988 stating that the District was not required to obtain an air emissions permit based on the projected maximum volatile chemical emissions from the air stripper. Influent concentrations detected from the treatment system have remained low, and an air permit is still not required.

The investigation to date has dismissed concerns for vapor intrusion issues at OU1 and OU2. Recent soil gas sampling has warranted further investigation of homes in the abutting residential area at OU3. Appropriate CTDEP remediation standards will be further considered.

Changes in Exposure Pathways. The primary routes of exposure to contamination identified in the ROD were through ingestion of drinking water and inhalation while showering. The estimated drinking water service area for the well field is 45,000 people and potential exposure routes have not changed. OU1 has been used as a drinking water source for portions of Norwalk since the mid-1960s.

No new contaminants or contaminant sources have been identified since the Supplemental RI/FS, which identified OU2 as the source of contamination to the well field. No toxic byproducts of the remedy were identified during the review.

Changes in Toxicity and Other Contaminant Characteristics. At the time of the ROD, benzene was the only COC that was classified as a known human carcinogen. Both TCE and methylene chloride were classified as probable human carcinogens. Risk estimates were provided for both known and probable human carcinogens at the time the ROD was prepared, and this practice has not changed in the last five years. Based on risk assessment procedures in use at the time of the RI, the incremental lifetime carcinogenic risk from the three carcinogens (benzene, methylene chloride, and trichloroethylene) considered for groundwater at the well field was calculated as 1.8×10^{-4} for adults. That risk assessment was cited in the ROD as the primary justification of the need for remedial measures.

At present, benzene remains the only COC that is classified as a known human carcinogen. However, since the ROD the carcinogenic classification of several contaminants of concern has been revised. TCE was classified as "Reasonably Anticipated to be a Human Carcinogen" in 2000. PCE and methylene chloride were added to this list in 1989.

Changes in Risk Assessment Methods. In 2003, toxicity values to assess noncancer effects for benzene were based on updated risk assessment methods (benchmark dose modeling). At the same time, EPA presented an updated method in which a range of toxicity values is used to assess cancer effects (rather than a single value). The remedy remains unchanged, however, since the target cleanup levels for groundwater were based on MCLs and there have been no changes to the MCLs.

Expected Progress Towards Meeting RAOs. No influent and effluent concentrations of contaminants have exceeded federal and/or state drinking water standards since the last five-year review. Effluent concentrations of contaminants (from samples collected immediately prior to discharge to the distribution system) have never exceeded federal and/or state drinking water standards. Therefore, the primary RAO established in the ROD (to "assure a reliable supply of safe, potable water to the public dependent on the well field") has been and continues to be met.

7.1.1.3 Question C: Has Any Other Information Come To Light That Could Call Into Question The Protectiveness Of The Remedy?

No other information has become available that could impact the protectiveness of the remedy.

7.1.2 OU2—Source Remediation Area (SRA)

7.1.2.1 Question A: Is The Remedy Functioning As Intended By The Decision Documents?

Based on the review of the ROD, Consent Decree, EPA-approved remedial design plans, and historical sampling data, the remedy for OU2 appears to be functioning as intended, with possible exception of plume containment. The ITS has performed to the specifications of the 1995 O&M Plan. Semiannual reports indicate that concentrations of VOCs in groundwater samples have decreased since system startup. Analysis of treatment system influent and effluent samples indicates that contaminants are being removed from groundwater prior to the discharge of water to the environment. Mass removal calculations indicate that VOC mass reduction continues to occur via the treatment of groundwater.

Although declining trends are apparent, concentrations of VOCs in groundwater at OU2 remain significantly above the cleanup standards that were established for the remedy. Groundwater samples collected in September 2006 revealed concentrations of VOCs in groundwater throughout OU2 exceeding MCLs by several orders of magnitude. Furthermore, water-level data collected semiannually do not clearly demonstrate that the plume is fully captured by pumping.

Pumping rates have declined gradually and currently range from 30 to 40 gallons per minute. Reconditioning of the pumping wells may be needed to reestablish previous pumping rates to ensure plume capture and maximize contaminant mass removal. Alternative groundwater extraction management schemes should be considered for maximum contaminant mass removal. For example, discontinued pumping of wells that are not effectively removing mass could minimize well interference and improve production from wells that effectively remove contaminant mass. Additional extraction wells may enhance migration of contaminants in fractured rock.

In addition to the operation of the SVE system, highly contaminated soils were removed from "hot spots" in 2005. In 2006 EPA determined that all soil cleanup goals have been achieved.

The air emissions from the ITS contain negligible VOCs. The system's emissions remain well below the threshold for which a permit is required. The treated groundwater discharge to the storm sewer and associated monthly monitoring meet the intent of the NPDES emergency authorization. It is anticipated

that the PRPs' contractor will work with CTDEP to obtain a new NPDES permit once the State's new permit program is in place. Solvent/condensate collected in drums during on-site carbon regeneration is properly manifested and periodically shipped to a hazardous waste recycling facility.

Institutional controls on groundwater use, as required by the ROD and modified by the 1997 ESD, are in place. Access to the Complex is limited by perimeter fencing with locked gates and posted no trespassing signs.

7.1.2.2 Question B: Are The Exposure Assumptions, Toxicity Data, Cleanup Levels, And Remedial Action Objectives (RAOs) Used At The Time Of The Remedy Selection Still Valid?

While an obvious reduction in VOC concentrations has been observed in parts of OU2 since system startup, the current concentrations of VOCs in groundwater remain orders of magnitude above drinking water standards (MCLs). Additionally, the concentrations of TCE in groundwater samples collected from wells located in the Complex have been relatively stable (with occasional upward spikes) since 1996. The latter observation seems to suggest that a continuing source of VOCs, possibly in the form of dense non-aqueous phase liquid (DNAPL), may be present in the Source Area. If this were found to be true, or if another previously unidentified source of contamination were found to exist in soils at the Complex, the remedial action may need to be reevaluated.

Soil cleanup standards were calculated during the pre-design phase of the remedial action, using a site-specific soil-water equilibrium partitioning model to determine the maximum allowable concentrations of VOCs in soil that could maintain contaminant levels in groundwater below MCLs. The model used site-specific data to simulate the movement of VOCs from soil to groundwater via the infiltration of water from the ground surface to the water table. Data collected during the pre-design investigation that was used to develop the model included the infiltration rate of water through the ground surface, lateral groundwater flow rate under the Site, organic carbon content of soil, and water content of soil at the Site. All of the assumptions and calculations made for the determination of these parameters remain valid.

7.1.2.3 Question C: Has Any Other Information Come To Light That Could Call Into Question The Protectiveness Of The Remedy?

Preliminary data obtained in the Phase I vapor intrusion pathway study in OU3 (TtNUS, 2006) indicates a potential threat to occupied structures in OU2 from soil vapor.

7.2 Technical Assessment Summary

According to data reviewed, observations from the site inspections, and interviews, the OU1 and OU2 remedies are functioning as intended by the ROD for each operable unit. Each remedy is removing VOCs from contaminated media and discharging treatment system effluent that is protective of human health and the environment. Since the influent groundwater concentrations to the OU1 air stripper are routinely below MCLs, the OU1 remedy can be considered complete and a success. Added pumping stress, however, such as during drought, could expand the contributing area of the well field into the OU3 area where concentrations of VOCs remain above MCLs.

Although the groundwater extraction system in OU2 continues to remove contaminant mass from the aquifer, groundwater monitoring results indicate VOC concentrations, while decreasing in most of OU2, are an order of magnitude higher than MCLs in many portions of the SRA. Additionally, groundwater concentrations in the Complex have not been significantly reduced by the operation of the groundwater extraction and treatment system, and remain orders of magnitude higher than MCLs. This may indicate

the presence of DNAPLs in OU2 that are contributing to sustained high VOC concentrations in the groundwater. If this is the case, remediation of groundwater to drinking water standards may not be technically practicable.

There have not been changes to the ROD-specified ARARs that impact the OU2 remedy. However, the results of the O&M phase appear to indicate that the RAOs may need to be reevaluated. While protective in the short term, the OU2 remedy's long-term protectiveness is questionable.

There are no additional routes of exposure and restrictions on groundwater use are in place. Land use at the Site has not changed since the RODs were issued and is not expected to change. Removal of the complex buildings has not added routes of exposure.

8.0 ISSUES

Issues that have been identified during this five-year review are listed by operable unit in Table 8-1.

Table 8-1. Issues at the Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut.

Issues	Affects Current Protectiveness	Affects Future Protectiveness
Operable Unit 2 (OU2)		
A large mass of contaminants remains in the source remediation area; high concentrations of VOCs persist in groundwater	No	Yes
The current declining pumping rate may not fully contain the plume	No	Yes
Elevated concentrations of contaminants in the Downgradient Area indicate that the treatment system is not fully containing the plume in OU2.	Yes	Yes
Vapor intrusion is a potential threat to businesses and residents in the area of the contaminant plume.	Yes	Yes
Operable Unit 3 (OU3)		
The extent and fate and transport of contaminants in ground water are not fully known, and vapor intrusion to residences and businesses is possible over an area that includes OU2 and OU3.	Yes	Yes

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow-up actions are listed by operable unit in Table 9-1.

Table 9-1. Recommendations and Follow-up Actions for the Kellogg-Deering Well Field Superfund Site, Norwalk, Connecticut.

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Operable Unit 2 (OU2)						
A large mass of contaminants remains in the SRA; high concentrations of VOCs persist in groundwater	Evaluate methods that could increase the rate of contaminant removal; implement viable technologies.	PRPs	USEPA	2012	No	Yes
The current declining pumping rate may not fully contain the plume	Test the efficiency of each extraction well and recondition or replace wells if needed.	PRPs	USEPA	2008	No	Yes
Elevated concentrations of contaminants in the Downgradient Area indicate that the treatment system is not fully containing the plume in OU2.	Review alternative pumping schemes to maximize contaminant removal and capture. Install additional wells west of OU2 to demonstrate hydraulic containment by pumping.	PRPs	USEPA	2008	Yes	Yes
Vapor intrusion is a potential threat to businesses and residents in the area of and near the contaminant plume.	Test soil gas concentrations near occupied buildings to determine the extent of the threat, if any.	EPA	USEPA	2008	Yes	Yes
Operable Unit 3 (OU3)						
The extent and fate and transport of contaminants in ground water are not fully known, a threat to public-supply wells continues, and vapor intrusion to residences and businesses is possible in OU3.	Perform additional studies.	PRPs	USEPA	2012	Yes	Yes

10.0 PROTECTIVENESS STATEMENT

The OU1 remedy for the Kellogg-Deering Well Field is currently protective of human health and the environment and exposure pathways that could result in unacceptable risks are being controlled by the wellhead treatment system. However, should contamination from OU2 not be fully contained and if it is moving toward the well field, protectiveness in the future could be threatened if wellhead treatment is no longer occurring.

With the possible exception of vapor intrusion, the remedy for OU2 currently protects human health and the environment because exposure pathways that could result in unacceptable risks are being addressed through treatment and/or institutional controls that prevent direct contact with contaminated soil, inhalation of contaminated soil vapors, and use of contaminated site groundwater. Groundwater extraction and treatment continue, but VOC mass removal has not yet achieved the cleanup standards that were established in the ROD. Based upon a review of recent groundwater sampling, the possibility exists that the current groundwater extraction and treatment system may not be fully effective in hydraulically containing the Source Area groundwater. If this is the case the remedy may not be protective in the long term. In order for the remedy to be protective in the long-term, a reevaluation of the OU2 remedy should be considered to ensure that groundwater at OU2 is being treated to the maximum extent practicable.

Recent soil gas sampling indicates that vapor intrusion to residences and businesses is possible over an area that includes OU2 and OU3. The vapor intrusion pathway should be investigated and appropriate response measures taken to address unacceptable risks. Based upon the results of further investigation, vapor intrusion could present a current risk to some occupants of properties in the OU2 and OU3 areas of the Site.

11.0 NEXT REVIEW

A third five-year review for OU2 and a fifth for OU1 will be conducted in 2012. Based on EPA's assessment of the progress of the OU2 treatment system in reducing groundwater contaminant concentrations to meet the cleanup standards identified in the ROD, additional actions may needed prior to the third five-year review for OU2. To address potential unacceptable vapor intrusion risks additional treatment measures maybe necessary prior to the next five year review for OU2 and OU3.

12.0 DOCUMENTS REVIEWED AND REFERENCES CITED

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Randall, A.D., 1996, Mean annual runoff, precipitation, and evapotranspiration in the glaciated northeastern United States, 1951-80: U.S. Geological Survey Open-File Report 96-395, 2 plates.

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WGI, 2001, Decision Document and Appendices for Kellogg-Deering Well Field-OU2. Washington Group International. April 30, 2001.

APPENDIX A - INTERVIEW DOCUMENTATION

INTERVIEW DOCUMENTATION FORM

The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
Leslie McVickar	Remedial Project Manager	U.S. Environmental Protection Agency	4/30/07
Jim Clark	Associate Principal	GZA Environmental, Inc.	5/29/07
Don Stever	Attorney for the PRPs		5/29-30/07
Jane Warren	Attorney for the land owners	McCarter & English	5/29-30/07
George Fulton	Engineer	Norwalk First Taxing District	5/29/07
Lori Mathieu	Supervisor, Source Water Protection Unit	Connecticut Department of Health	6/19/07
Mike Greene	Director of Planning and Zoning	City of Norwalk	6/19/07
Graham Stevens	Project Manager	Connecticut Department of Environmental Protection	5/30/07
Name	Title/Position	Organization	Date

INTERVIEW RECORD

Site Name: Kellogg-Deering Well Field Site, Norwalk, Connecticut		**EPA ID No.:** CTD980670814
Subject: Five Year Review - 2007	**Time:** 11:00 am	**Date:** 5/29/07
Type: Telephone X Visit Other **Location of Visit:**		Incoming Outgoing

Contact Made By:

Name: Forest P. Lyford	**Title:** Geologist	**Organization:** USACE

Individual Contacted:

Name: Jane Warren	**Title:** Attorney for the property owners	**Organization:** McCarter and English
Telephone No: 860-275-6700 **Fax No:** **E-Mail Address:**	**Street Address:** Not provided **City, State, Zip:**	

Summary Of Conversation

Q1: What is your overall impression of the project and site?
A1: Despite source removal operations, a significant source remains and groundwater is not remediated.

Q2: Are you aware of any issues the five-year review should focus on?
A2: The issue of a very high ground-water source needs to be addressed. There is also a problem quantifying the source.

Q3: Who should USACE speak to in the community to solicit local input?
A3: There are no local contacts.

Q4: Is the remedy functioning as expected?
A4: The system is not operating as anticipated when the consent decree was signed.

Q5: Has there been any significant changes in the O&M activities or a chance to optimize the O&M?
A5: There may be issues when the property is put to another use. That could affect O&M.

Q6: Is the Town actively involved in the site?
A6: No, but there is some interest relative to the planned demolition of buildings. Water will be required during demolition.

Q7: Do you feel that information related to the site is readily available?
A7: Do not know.

Q8: Have there been any changes in the site or surrounding property in the last 5 years, or are changes planned?
A8: Some appliances have been dumped on site.

Q9: Has the site had any negative economic impacts on the town?
A9: The property cannot be marketed in its current state. Demolition will improve the marketability of the site.

Q10: Are you aware of any changes in the state ARARs, groundwater quality standards, etc., since 1997?
A10: Volatilization criteria are currently being amended.

Q11: Are you aware of any pending or future water needs or any change in water usage in the area, such as increased production from OU1?
A11: Not aware of changes.

INTERVIEW RECORD

Site Name: Kellogg-Deering Well Field Site, Norwalk, Connecticut		**EPA ID No.:** CTD980670814	
Subject: Five Year Review - 2007		**Time:** 11:00 am	**Date:** 5/29/07
Type: Telephone X Visit Other **Location of Visit:**		Incoming Outgoing	
Contact Made By:			
Name: Forest P. Lyford	**Title:** Geologist	**Organization:** USACE	
Individual Contacted:			
Name: James J. Clark	**Title:** Associate Principal	**Organization:** GZA, Inc	
Telephone No: 860-286-8900 **Fax No:** 860-243-9055 **E-Mail Address:** jclark@gza.com		**Street Address:** 120 Mountain Avenue **City, State, Zip:** Bloomfield, CT 06002	

Summary Of Conversation

Note: Also present from GZA, Inc., was David J. Rusczyk.

Q1: What is your overall impression of the project and site?
A1: The system is operating as designed. The soil vapor extraction system worked intermittently for several years.

Q2: Are you aware of any issues the five-year review should focus on?
A2: None. This should be a normal five-year review.

Q3: Who should USACE speak to in the community to solicit local input?
A3: There are no local contacts.

Q4: Is the remedy functioning as expected?
A4: The system is operating as designed.

Q5: Has there been any significant changes in the O&M activities or a chance to optimize the O&M?
A5: There have been no changes. He will provide costs.

Q6: Is the Town actively involved in the site?
A6: No.

Q7: Do you feel that information related to the site is readily available?
A7: Do not know.

Q8: Have there been any changes in the site or surrounding property in the last 5 years, or are changes planned?
A8: There have been some commercial ownership changes.

Q9: Has the site had any negative economic impacts on the town?
A9: The town is losing revenue and jobs because the factory is not operating.

Q10: Are you aware of any changes in the state ARARs, groundwater quality standards, etc., since 1997?
A10: No changes.

Q11: Are you aware of any pending or future water needs or any change in water usage in the area, such as increased production from OU1?
A11: Not aware of changes.

INTERVIEW RECORD

Site Name: Kellogg-Deering Well Field Site, Norwalk, Connecticut		**EPA ID No.:** CTD980670814
Subject: Five Year Review - 2007	**Time:** 2:00 pm	**Date:** 5/29/07
Type: Telephone X Visit Other **Location of Visit:**		Incoming Outgoing
Contact Made By:		
Name: Forest P. Lyford	**Title:** Geologist	**Organization:** USACE
Individual Contacted:		
Name: George Fulton	**Title:** District Engineer	**Organization:** First Taxing District, City of Norwalk, Water Department
Telephone No: 203-847-7387 **Fax No:** **E-Mail Address:**	**Street Address:** 12 New Canaan Avenue **City, State, Zip:** Norwalk, CT 06851	

Summary Of Conversation

Note: Also present from the First Taxing District were Franko Chieffalo, Operations Director; Jim Fulton, Attorney; Michael Elliot, Engineer; and Tracey Pierson, Water Quality Coordinator.

Q1: What is your overall impression of the project and site?
A1: He said he could not say much about the site (OU2). VOCs have declined at their well and treatment has helped. He did not know when VOCs entered the well field. They seemed to reach a peak after the Superfund Program was initiated.

Q2: Are you aware of any issues the five-year review should focus on?
A2: Closure is needed; perhaps a supplemental treatment is needed. He expressed uncertainty about the outlet for VOCs downstream and the possibility that they may reach Long Island Sound.

Q3: Who should USACE speak to in the community to solicit local input?
A3: The District receives few inquiries. There is a level of confidence to know there is a treatment operation in progress at the well field.

Q4: Is the remedy functioning as expected?
A4: They did not know what to expect (at OU2). The District will solve the problem of VOCs at the well field themselves.

Q5: Have there been any significant changes in the O&M activities or a chance to optimize the O&M?
A5: There is an obligation to change the air stripper (as stated in the ROD). The stripper is inspected frequently. A pan was changed to give better distribution.

Q6: Are you aware of any residential well sampling efforts?
A6. There are no residential wells.

Q7: Is the Town actively involved in the site?
A7: Level A (wellhead protection) mapping is underway. The city is setting up a board to monitor (Level A) area. New construction must be submitted to the Water District for review. The city will be doing inspection for chemical usage. A board will monitor land uses, and will be interested in use of the site (OU2).

Q8: Do you feel that information related to the site is readily available?
A8: No. The District was not informed when the plant started operating. EPA now plans to keep the Water District informed. There has been some exchange of misinformation.

Q9: Have there been any changes in the site or surrounding property in the last 5 years, or are changes planned?
A9: There has been major construction of a power substation by Connecticut Power and Light on the other side of the river.

Q10: Has the site had any negative economic impacts on the town?
A10: There have been no impacts on the Well Field. The District has not been selling water to the closed facility (at OU2).

Q11: Are you aware of any changes in the state ARARs, groundwater quality standards, etc., since 2002?

A11: No.

Q12: Are you aware of any pending or future water needs or any change in water usage in the area, such as increased production from OU1?
A12: The District may be approached by other communities to supply water, particularly during drought.

INTERVIEW RECORD

Site Name: Kellogg-Deering Well Field Site, Norwalk, Connecticut		**EPA ID No.:** CTD980670814
Subject: Five Year Review - 2007	**Time:** 4:00 pm	**Date:** 6/19/07
Type: X Telephone Visit Other **Location of Visit:**	X Incoming Outgoing	

Contact Made By:

Name: Forest P. Lyford	**Title:** Geologist	**Organization:** USACE

Individual Contacted:

Name: Mike Greene	**Title:** Director of Planning and Zoning	**Organization:** City of Norwalk

Telephone No: 203-854-7701 **Fax No:** **E-Mail Address:**	**Street Address:** 125 East Avenue **City, State, Zip:** Norwalk, CT 06856

Summary Of Conversation

Q1: What is your overall impression of the project and site?
A1: Mr. Greene would like to see the property developed.

Q2: Are you aware of any issues the five-year review should focus on?
A2: He would like to see some discussion of redevelopment potential. Also a discussion of ultimate cleanup.

Q3: Is the Town actively involved in the site?
A3: The town will actively support any activity that leads to redevelopment of the site. He referred to a draft master plan of conservation and city development for the City of Norwalk. He later faxed parts of a Plan of Development for the City of Norwalk, 1990-2000, relating to flood hazards and aquifers, and "City of Norwalk, Plan of conservation & Development" relating to inland waterways, aquifers, and sanitary sewers. He suggested contacting the Public Works Department (203-854-7790) for information about public works features near the site.

INTERVIEW RECORD

Site Name: Kellogg-Deering Well Field Site, Norwalk, Connecticut	**EPA ID No.:** CTD980670814

Subject: Five Year Review - 2007		**Time:** 3:00 pm	**Date:** 6/19/07
Type: X Telephone Visit Other **Location of Visit:**		X. Incoming Outgoing	
Contact Made By:			
Name: Forest P. Lyford	**Title:** Geologist	**Organization:** USACE	
Individual Contacted:			
Name: Lori Mathieu	**Title:** Supervisor, Source Water Protection Unit	**Organization:** Connecticut Department of Public Health	
Telephone No: 860-509-7333 **Fax No:** **E-Mail Address:**		**Street Address:** 410 Capitol Ave. **City, State, Zip:** Hartford, CT 06134	

Summary Of Conversation

Q1: What is your overall impression of the project and site?
A1: Ms. Mathieu stated that the water company has proposed installing another well and does not believe contamination is a threat. She contends that there is still a threat and the Department of Health does not want another well in this location because of possible impairment of water quality at the well field. The main concern is drinking water quality, even without a new well.

Q2: Are you aware of any issues the five-year review should focus on?
A2: She stated that the various interested parties should sit down and discuss issues. There is concern about the possible interference that might result from changes in pumping and the possibility of intercepting the plume of contaminated ground water.

Q3: Is the remedy functioning as expected?
A3: NFTD has suggested some alternative cleanup methods. They have expressed concern about not getting information about the operations (at OU2). She feels that the treatment system (at OU2) has not been effective in the short term and there have been no discussions about long-term solutions.

Q4: Are you aware of any residential well sampling efforts? If so, do you know where sample results might be obtained?
A4: She suggested checking with the local board of health. Most residents are probably served by the public water-supply system. Wells drilled for irrigation must be processed through the state. Sometimes older neighborhoods have former domestic wells that are used for irrigation yards and gardens.

INTERVIEW RECORD

Site Name: Kellogg-Deering Well Field Site, Norwalk, Connecticut		**EPA ID No.:** CTD980670814
Subject: Five Year Review-2007	**Time: 10:00** pm	**Date: 4/30/07**
Type: **Telephone** Visit Other **Location of Visit:** Plainfield, Connecticut	Incoming X Outgoing	

Contact Made By		
Name: Forest P. Lyford	**Title:** Geologist	**Organization**: USACE
Individual Contacted:		
Name: Leslie McVickar	**Title:** EPA Remedial Project Manager	**Organization**: U.S. Environmental Protection Agency
Telephone No: (617) 918-1374 **Fax No:** **E-Mail Address:**	**Street Address:** 1 Congress Street, Suite 1100 **City, State, Zip:** Boston, MA 02114	

Summary Of Conversation

Q1: What is your overall impression of the project and site?
A1: Ms. McVickar is mostly involved in vapor-intrusion concerns in the Downgradient Area (OU3).

Q2: Are you aware of any issues the five-year review should focus on?
A2: She suggested talking to Terry Connelly, EPA Remedial Project manager, about ground-water issues.

Q3: Who should USACE speak to in the community to solicit local input?
A3:

Q4: Is the remedy functioning as expected?
A4.
Q5: Is the Town actively involved in the site or do they show an active interest?
A5: She feels that the City is generally supportive of site activities.

Q6: Have there been any changes in the site or surrounding property in the last 5 years, or are changes planned?
A6: Plans were to remove the buildings, but she did not know if that actually happened.

INTERVIEW RECORD

Site Name: Kellogg-Deering Well Field Site, Norwalk, Connecticut		**EPA ID No.:** CTD980670814
Subject: Five Year Review - 2007	**Time:** 10:00 am	**Date:** 5/30/07
Type: Telephone X Visit Other **Location of Visit:**		Incoming Outgoing
Contact Made By:		
Name: Forest P. Lyford	**Title:** Geologist	**Organization:** USACE

Individual Contacted:		
Name: Graham Stevens	**Title:** CTDEP Project Manager	**Organization:** State of Connecticut Department of Environmental Protection
Telephone No: 860-424-4166 **Fax No:** **E-Mail Address:**	**Street Address:** 79 Elm Street **City, State, Zip:** Hartford, CT 06106	

Summary Of Conversation

Q1: What is your overall impression of the project and site?
A1: As to OU1, the presumptive conclusion is that the remedy is protective of human health. As to OU2, the containment system continues to operate as designed. Pumping must continue because of the risk to the well field. CTDEP would not support discontinuation of pumping at OU2. As to OU3, the extent of contamination is not well characterized. Both OU2 and OU3 continue to pose a threat to human health and the environment.

Q2: Are you aware of any issues the five-year review should focus on?
A2: Vapor intrusion in OU3; contaminant migration; discharge to the river.

Q3: Who should USACE speak to in the community to solicit local input?
A3: He suggested contacting Lori Mathieu, Conn. Dept. of Public Health. The City Engineer may have information on storm drainage systems near the site.

Q4: Is the remedy functioning as expected?
A4: No for OU3 because there is no remedy. For OU2, the remedy is OK for containment, but the ROD requires more. The remedy is not protective of on-site occupants. There is the problem of long-term protectiveness without source removal.

Q5: Are you aware of any residential well sampling efforts?
A5: No well survey has been performed. He does not know who would do that.

Q6: Do you feel that information related to the site is readily available?
A6: CTDEP has all information for the site, an extensive file. He understands that the local library has the latest ITS reports.

Q7: Are you aware of any changes in the state ARARs, groundwater quality standards, etc., since 1997?
A7: Changes in ARARs were proposed in 2002 but never promulgated.

Q8: Are you aware of any pending or future water needs or any change in water usage in the area, such as increased production from OU1?
A8: CTDEP is not opposed to installation of a backup well at OU1. CTDPH is responsible for that decision. Additional information for OU3 would be helpful for assessing impacts. Sentinel monitoring wells that were originally required by the ROD (for OU1) should be implemented.

INTERVIEW RECORD

Site Name: Kellogg-Deering Well Field Site, Norwalk, Connecticut		**EPA ID No.:** CTD980670814	
Subject: Five Year Review - 2007		**Time:** 1100 am	**Date:** 5/29/07
Type: Telephone X Visit Other **Location of Visit:**		Incoming X Outgoing	
Contact Made By:			
Name: Forest P. Lyford	**Title:** Geologist	**Organization:** USACE	
Individual Contacted:			
Name: Don Stever	**Title:** Attorney for PRP Group	**Organization:**	
Telephone No: 212-536-4861 **Fax No:** **E-Mail Address:**		**Street Address:** Not provided **City, State, Zip:**	

Summary Of Conversation

Q1: What is your overall impression of the project and site?
A1: DNAPL appears to be in fractured bedrock. Groundwater remedial standards have not been met. .

Q2: Are you aware of any issues the five-year review should focus on?
A2: None. This should be a normal five-year review.

Q3: Who should USACE speak to in the community to solicit local input?
A3: There are no local contacts.

Q4: Is the remedy functioning as expected?
Q4: The system is operating as designed.

Q5: Have there been any significant changes in the O&M activities or a chance to optimize the O&M?
Q5: Costs can be provided by GZA.

Q6: Are you aware of any residential well sampling efforts?
A6: There are no residential wells.

Q7: Is the Town actively involved in the site?
A7: No.

Q8: Do you feel that information related to the site is readily available?
Q8: Do not know.

Q9: Have there been any changes in the site or surrounding property in the last 5 years, or are changes planned?
A9: None in the last 5 years. Demolition of the buildings is planned.

Q10: Has the site had any negative economic impacts on the town?
A10: The site is not yielding taxes. Derelict buildings have an effect on the real-estate market.

Q11: Are you aware of any changes in the state ARARs, groundwater quality standards, etc., since 1997?
A11: No changes.

Q12: Are you aware of any pending or future water needs or any change in water usage in the area, such as increased production from OU1?
A12: Not aware of changes.

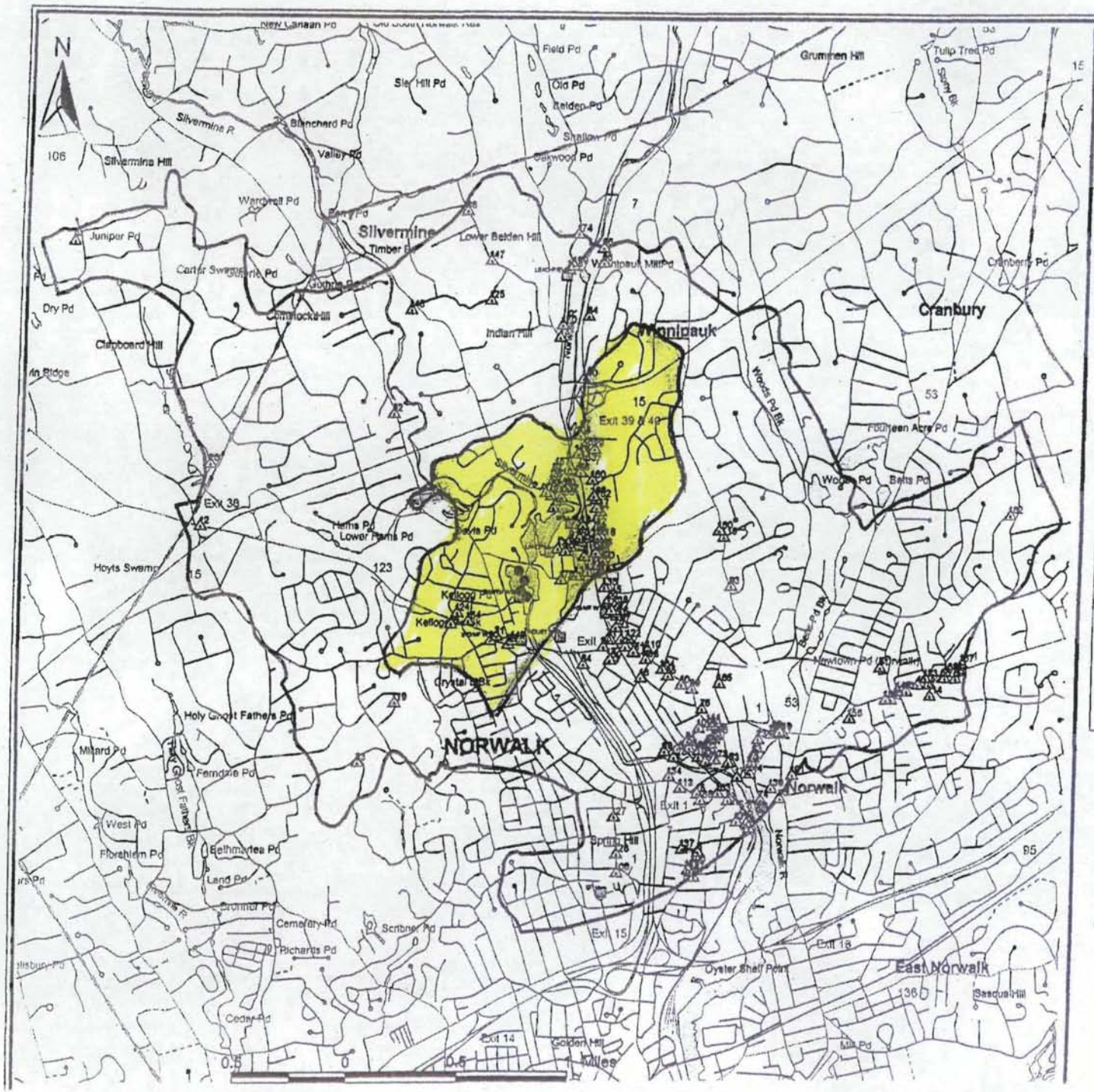
APPENDIX B – ARARs AND TBCs

IDENTIFICATION OF ARARs AND TO-BE-CONSIDERED CRITERIA, ADVISORIES, AND GUIDANCE

REQUIREMENT/GUIDANCE	STATUS	REQUIREMENT/GUIDANCE SYNOPSIS
OPERABLE UNIT 1		
No ARARs are specified in the ROD. Relevant Federal criteria, advisories and guidance and State standards include:		
Federal Criteria, Advisories and Guidance		
• National Drinking Water Advisory Council (NDWAC) recommendations		
• Proposed Maximum Contaminant Level (PMCL), Recommended MCL (PMCL) and Proposed-Recommended MCL (PRMCL)		
• Suggested Adjusted Acceptable Daily Intake (AADI)		
Connecticut Standards		
• Connecticut Air Hazard Limited values		
• Connecticut Drinking Water Regulations		
OPERABLE UNIT 2		
Federal Regulatory Requirements and Guidance		
Safe drinking Water Act regulations establishing MCLs (40 CFR 141.11-141.16)	Relevant and Appropriate	Establish contaminant concentration levels in public dinking water. MCLs are the target cleanup levels for groundwater at the source area. Attaining the soil cleanup goals will ensure that any future migration of residual contaminants in the soil will not exceed MCLs in the source area.
Clean Water Act, National Pollutant Discharge and Elimination System (40 CFR 122-125)	Applicable	Discharges from the treatment systems to surface water will be in compliance with the Clean Water Act.
RCRA General Facility, Prepared-ness and Prevention, Contingency Plan and Emergency Procedure Requirements (40 CFR 264, misc.)	Applicable	Operations will comply with periodic monitoring, inspections, site security, spill control, and maintenance requirements. Contingency plans will be in place.
RCRA Container Requirements (40 CFR 264, Subpart I)	Applicable	Packing and accumulations of waste materials will comply with these requirements for use and management of containers.
RCRA Manifesting, Recordkeeping, and Reporting (40 CFR 264.70-264.77)	Applicable	Recordkeeping and manifesting of recovered waste TCE will comply with these requirements.
U.S. Department of Transportation Rules for Transportations of Hazardous Materials (49 CFR Parts 107, 171.1-171.500)	Applicable	Requirements for manifests and transportation of hazardous wastes off site will follow these standards.
State of Connecticut Regulatory Requirements and Guidance		
Connecticut Water Quality Standards and Classification (22a-426)	Applicable	Applicable to aquifer restoration and discharges to the Norwalk River and the aquifer. MCLs and public health code levels will be attained to restore the aquifer to its designated use as a drinking water aquifer and surface water discharges will meet NPDES

		limitations.
Standards for Quality of Public Drinking Water; Connecticut Public Health Code (19-13-B102)	Relevant and Appropriate	Cleanup of the aquifer will be conducted in accordance with these standards of water supplies.
Connecticut Discharge Permit Regulations	Applicable	Supplement the NPDES requirements. Treated groundwater discharged to a surface water must comply with water quality standards and complete routine monitoring and recordkeeping activities.
Connecticut Hazardous Waste Rules (22a-449) (Title 22a-430)	Applicable, where more stringent than federal requirements	Treatment system operation will comply with these requirements.
Connecticut Air Pollution Control Regulations (22a-174)	Applicable	Air emissions from the treatment system will comply with State air quality standards.
Connecticut Public Health Code (19a-36)	Applicable	This requirement provides controls to restrict groundwater use from private wells as potable water.

APPENDIX C - KELLOGG-DEERING WELL FIELD SOURCE WATER MAP



Source Water Assessment Program
Source Water Map

Kellogg-Deering Wellfield
Norwalk First Taxing District

Legend

- Significant Potential Contaminant Sources (SPCS's)

DEP Aquifer Protection Areas (APA's)

- Level "A"
- Level "B"

- APA Wells

Leachate and Watewater Discharges

- ACTIVE
- INACTIVE

PUBLIC HEALTH

Keeping Connecticut Healthy

Connecticut Department of Public Health
Drinking Water Division
410 Capitol Avenue, MS#51 WAT
P.O. Box 340308
Hartford, CT 06134

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